MARCH 27, 1937

ELECTRICAL WORLD

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IN THIS ISSUE

DEPENDABLE — STURDY ADAPTABLE . .

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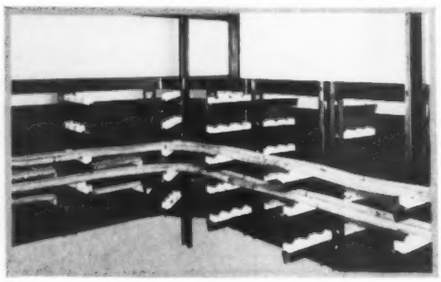

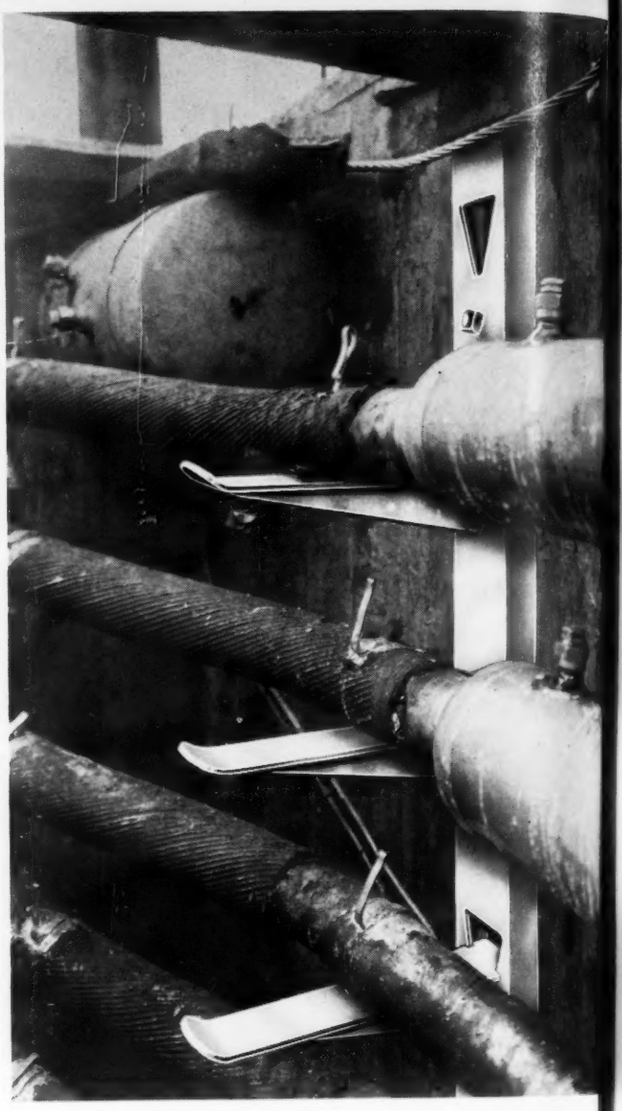

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Coming Features

R.E.A. Line Construction Data

What is perhaps the first authoritative presentation of data on the engineering and construction details of R.E.A.-financed rural lines will appear in the April 24 issue of ELECTRICAL WORLD. This feature will cover very closely the same information for R.E.A. lines as was published in ELECTRICAL WORLD of February 29, 1936, for 194 power company lines. Besides line characteristics, drawings illustrating practices on R.E.A.-financed lines taken from their suggested specifications will be included.

Application of Sodium Lighting to Highways

In an article soon to appear George A. Eddy will present suggestions for realizing maximum effectiveness from sodium highway lighting installations. Characteristics of the sodium-lighting circuit and cost estimates for a series system are to be included.

Public Relations Audit Checks Customers' Attitude

A door-to-door survey of the Pacific Gas & Electric Company's customers keeps this utility informed of public reactions to its service. This audit will be described in a coming article which will tell how customers' reactions are used by the company.

Transmission Faults Located Accurately

Telemetrograph, soon to be described, uses variable high-frequency impulse beats to disclose location of shorts and grounds on overhead lines.

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ELECTRICAL WORLD

MARCH 27, 1937

A Code of Compromise

This year, on its fortieth anniversary, the National Electrical Code will appear in a completely altered form. The substance, aside from the regular biennial revision made two weeks ago, will be the same. The arrangement will be entirely different, and because of the grouping of related material it should be easier to use and easier to expand as new materials and applications require regulation.

The National Electrical Code, though sponsored by the National Fire Protection Association, is no longer an "underwriter's code," as it was commonly known, but is a code of and by the electrical industry. Every group in the industry that is concerned with the protection of the public is represented upon the N.F.P.A. Electrical Committee, which has the responsibility for keeping the code up to date.

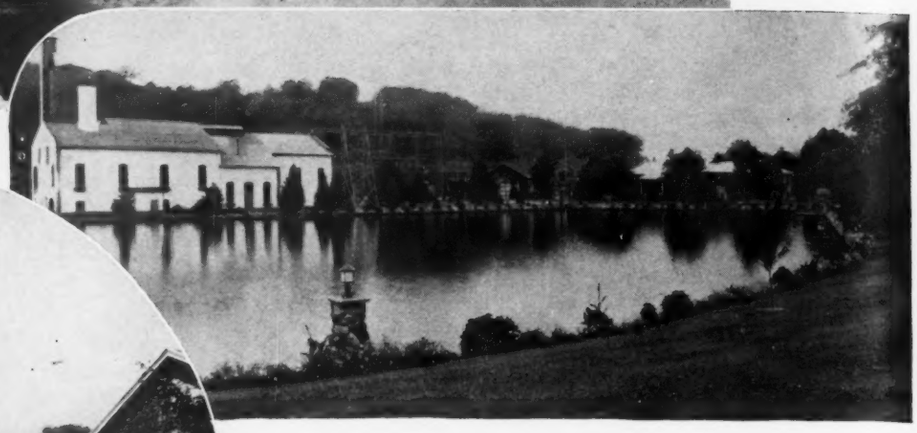
Because it is a set of regulations developed largely by people with commercial interests and because these interests are not always the same for the several groups, the code is quite naturally in places a code of compromise. And it is this element of compromise that is not always appreciated by those who would have the code pure and untainted by any commercialism.

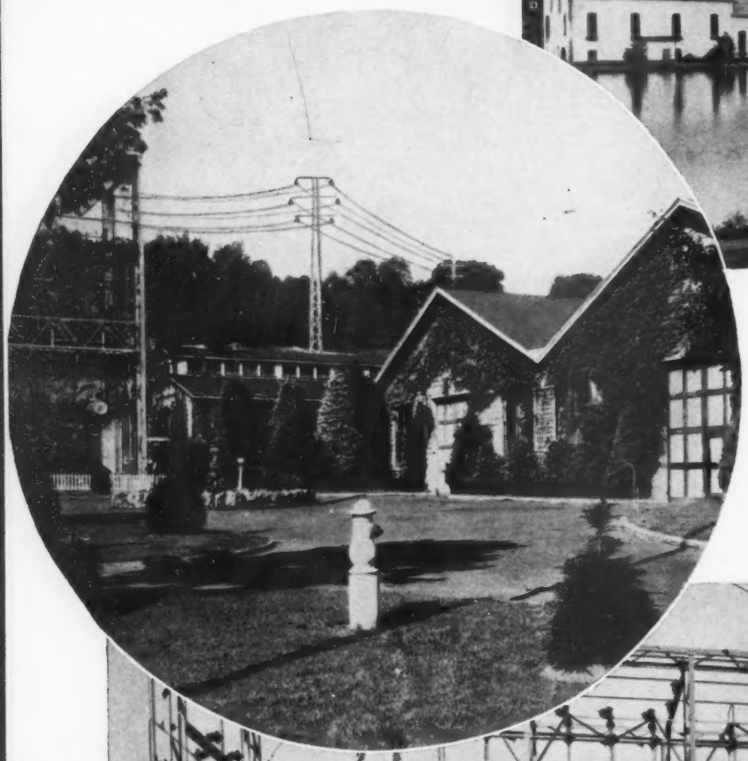
Several times in the past the code came near going on the rocks when the spirit of compromise was too long making its appearance. Today there is more tolerance and liberalism, and that in itself is good, but it should not be allowed to go too far. Already there is a move under way by organized labor to take a more active, if not dominant, part in local and state legislation, while at the same time it has not given up its ambition to take the code out of the hands of the electrical industry and place it with a federal bureau.

Should the National Electrical Code ever get out of the hands of the electrical industry and into channels where labor would have a prominent voice, then the element of liberalism would be materially weakened. Labor is opposed, and understandably so, to the introduction of new and lower cost wiring methods, because such lower costs are almost invariably predicated upon less installation labor.

The struggle for dominance in the regulation of the installation of electrical materials is only just beginning. So long as there is a balance of power and the spirit of compromise can prevail, the public will be best served and wiring regulation will make progress. Let any single group get the upper hand and the industry and the public will be the losers.

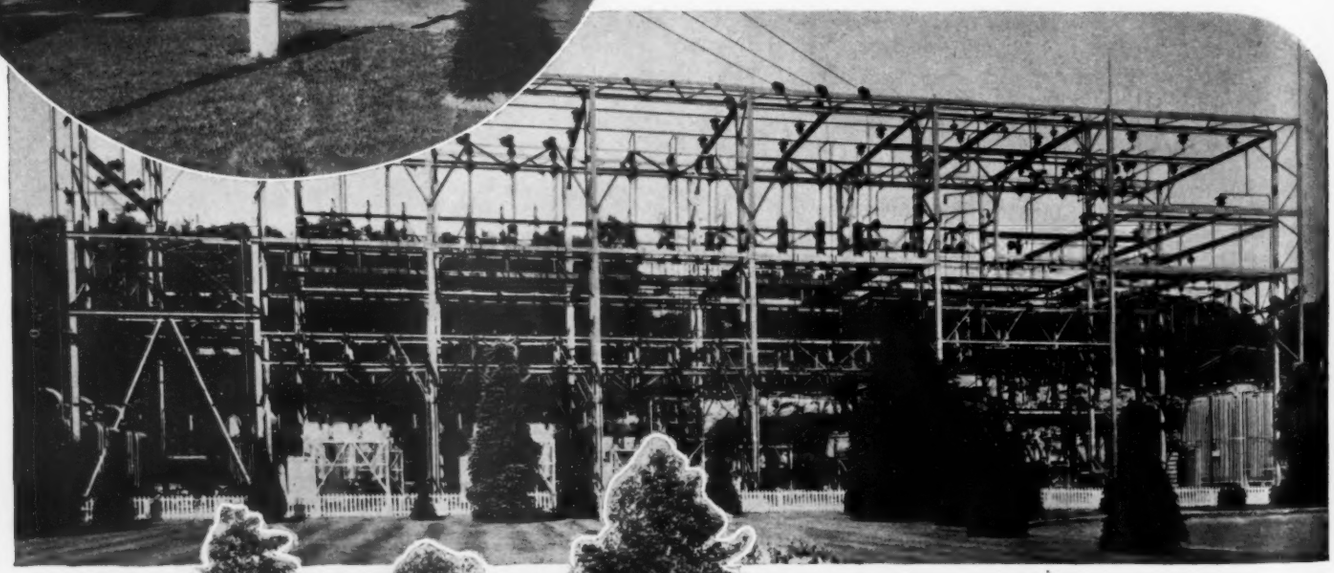
The National Electrical Code must never be permitted to be an instrument for defeating progress by preventing new methods of merit from gaining market acceptance. At the same time it should be slow to permit use of products of doubtful merit. While it remains a code of and by the electrical industry, though commercial interests be at stake, the spirit of compromise must prevail to such a degree as to permit progress in the interest both of the industry as a whole and the public.





POWER IN PLEASING DISGUISE

Though it looks like a country club, it's really a combination substation, generating station and adjoining headquarters of the Orange & Rockland Electric Company in lower Orange County, New York. When conditions warrant, utility properties can harmonize in exclusive residential areas.



Modernization and New Uses Help the Power Salesman

Two Separate Avenues to Added Power Sales Available to Wide-Awake Salesmen

By L. J. LAMBERGER
Manager Wholesale Sales and Service, Duquesne Light Company

WITHOUT a doubt modernization of industry and new uses of electricity offer attractive possibilities for securing new electric load, and I believe the wide-awake salesman will keep these two factors uppermost in his mind.

As for modernization, I recall one case where this theme secured 500 kw. of entirely new load and resulted in a very happy and satisfied customer. In this case the product was sheet copper, hot and cold rolled through various stages from the ingot to the finished product. With the exception of two cold mills, the rolling equipment consisted of antiquated low-speed mills powered by low-pressure steam engines with enormous flywheels. Prior to the depression, the manufacturer could not interrupt his operation to replace this antiquated equipment with modern high-speed mills and during the depression could not justify the expenditure. About eighteen months ago he installed a new mill geared to a 500-hp. motor, for which power is purchased. Due to an increase in speed and a heavier draft, production on this particular mill has been increased 40 per cent, and plans are now under way to modernize the remainder of the rolling equipment.

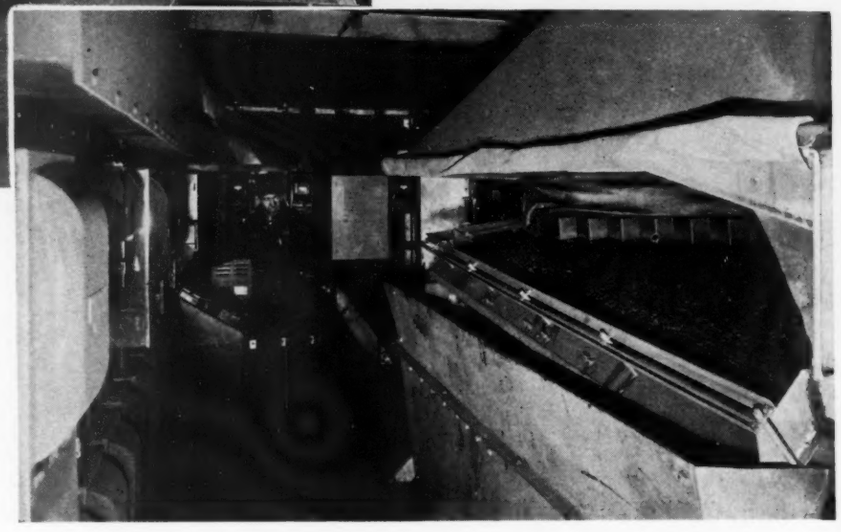
A second case of modernization occurred in a wire mill in the Pittsburgh district. The wire is hot drawn to approximately $\frac{3}{8}$ in. diameter and then cold drawn to the various gages in commercial use. Each reduction in gage was a separate operation requiring one man for each draw bench. The smaller gages required fifteen to twenty operations. The cost of manpower for operation and supervision, therefore, was quite extravagant. Recently this concern installed three new cold mills with five or six reductions to each mill, and with each mill under the supervision of one man. The ends of the coils of wire are electrically welded so that a continuous operation is assured. This modernization scheme has added 225 kw. to the load and has materially lowered the cost of manufacturing.

A coal company could not dispose of its slack because it wasn't cleaned. It had a cleaning plant for its larger size coal, but none for the smaller sizes. A new cleaning plant was installed, which allowed the company to produce all sizes of cleaned coal down to the smaller grades, thus opening up an untouched market for its product. This plant is now truly modern and is in a position to accept orders for all commercial and domestic grades of coal.

A large meat packing concern in the Pittsburgh district can boast of the fact that it now has the last word in modern packing house equipment. The necessity for modernization became apparent about eighteen months ago and subsequent studies convinced the company of the economy of such a move. New sausage machines, new conveyors and other new handling

"It has been my experience that modernization of a plant, which nearly always calls for a major capital investment, is almost as elusive as the will-o'-the-wisp. When business is booming, industry will not willingly take the loss of time and production to modernize, and during a depression, even though the capital may be available, industry is reluctant to spend it. From these two statements it would appear that progress is stymied. However, I find that there is a time when the alert executive will look to plans for modernizing his plant and through his belief in his product will even borrow money to have these plans materialize. This time is after the low point in the depression curve has passed and the business curve is strongly and steadily upward. We have been in this phase of our recovery period for about 2½ years."

A modernized lighting installation replacing obsolete equipment in a Pittsburgh manufacturing plant. Lighting intensity was raised from an average 7 to 19 ft.-candles



"Slack" coal passing through dry cleaning process in newly installed, motor-driven cleaning plant

equipment were purchased. Refrigerating equipment was revamped and brought up to date. This modernization move made it feasible to close down completely the isolated plant, which had been in operation for years, and contract with this company for a total of 2,150 kw. of new load. All motors were changed from d.c. to a.c., thus eliminating the conversion loss and a higher maintenance cost. New refrigerating machines were installed, using only a small part of the space formerly occupied by the steam-driven equipment.

Finally, a plant manufacturing various types of tool steels is now operating its steam hammers with compressed air. Two 600-hp. motor-driven air compressors have been installed to supply the air required.

Role of lighting in modernization

It would be a serious oversight if I did not bring into this discussion of modernization improved lighting systems and more adequate lighting in buildings, factories, stores, etc. Factory managers have begun to realize the importance of adequate lighting. Owners and managers of office buildings find themselves in a position where they are almost compelled to modernize their lighting system to keep tenants satisfied and to keep their space rented. Here again the individual increases in load are not large, but due to the broad scope of this activity the cumulative effect is attractive blocks of new load.

For example, the management of a twenty-story office building now finds it necessary to refixture the entire building in order to increase the lighting intensity and to make its office space more attractive to prospective tenants. The modernization of the lighting system will be carried out gradually. Semi-indirect lighting fixtures designed for 500-watt lamp capacity have been purchased. This will raise the intensity from 4 to about 15 ft.-candles.

Even greater results can be obtained in the industrial field. In many factory buildings larger increases in load will be required to secure the desired lighting intensity. This is due to the extreme light-absorbing qualities of the surfaces to be lighted. A Pittsburgh manufacturer has rewired and refixtured his six-story manufacturing building, using dome reflectors with 200-watt lamps. The increase in load amounted to 50 kw. or 300 per cent. The lighting intensity, which was originally between 2 and 5 ft.-candles, has now been raised to from 12 to 15 ft.-candles.

In another industrial plant the office was refitted with 500-watt semi-indirect units which increased the load in the office by 13 kw. To cite another case, 29 kw. was installed in the machine shop, bringing the total increase in this plant up to 41 kw.

New uses and new applications

New uses do not necessarily mean new electrical equipment. In some cases they mean new applications of known and proved uses and equipment. Since we are mostly concerned with the immediate future, I feel that new uses of existing electrical equipment are of more importance as a helper to the power salesman than new inventions which have not yet proved themselves. For instance, electric welding was known long before the recent depression, and even prior to that time numerous patents had been granted which tended to refine and expand the applications of the original welders. The spot welder was not a lucrative revenue builder and, in fact, the electric welder did not become very attractive to the electric utilities until the seam welder came into existence. The popular sizes seem to be from 25 to 50 kw. capacity, and it has been our experience that a 50-kva. welder of this type will produce a revenue of $500 to $600 per year.

The industry is still experimenting to find new uses for these welders, and I believe that in the future we may expect to see them used in fields yet unexplored.

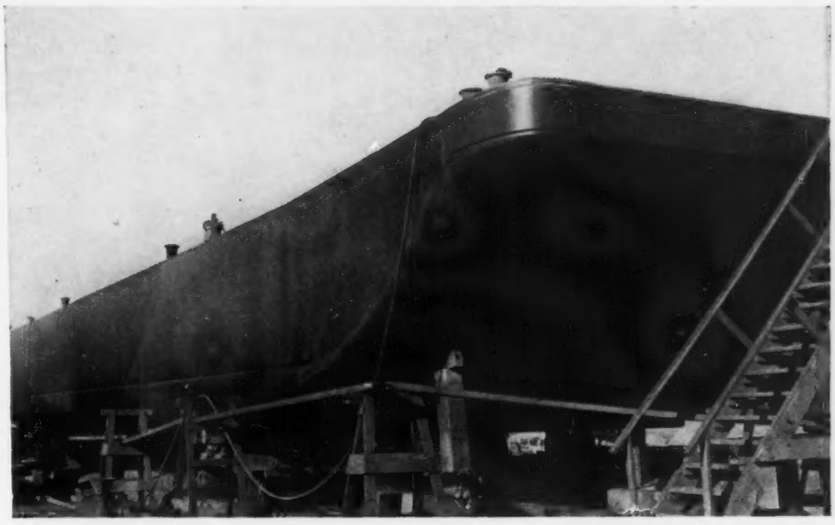
New uses for seam welder

As an illustration of the development of a new use for electric seam welders I cite the case of one of our customers who, until 1934, riveted all the deck plates and side plates on his river boats and barges. This customer now has about 25 electric welders which are used to fabricate these boats, with the result that it is now hard to find a rivet in their fabricating process. The customer claims greater strength, more economical production, no loose joints due to vibration, less corrosion due to water and the elements and lower maintenance cost.

We have a customer who is now welding the seams of large commercial storage tanks. He operates eight of these portable electric welders. In this case, in addition to welding the seams in the tank, the fabricated tower is also largely electrically welded. The same claims of economy, strength, etc., are made as in the former illustration.

New uses for motors, lamps

Many new uses have been found for motors. In many cases the individual load is small, but the cumulative loads are attractive if these new uses are made known to our customers. Electric industrial trucks are not new, but new types are being developed from time to time. An industrial truck with a chain conveyor floor to facilitate loading is new and has recently been placed on the market. The use of electricity for lighting is, I believe, the oldest use, but new uses for electric lighting are still developing. The sodium-vapor lamp recently developed will open new uses of current for lighting. An article which appeared in the June, 1936, issue of *Food Industries* tells of a new lamp which provides a means of killing all types of bacteria and mold spores. The article states that practical tests have definitely established the effectiveness of the germicidal radiation from this ultra-violet lamp in preventing growths of mold and bacteria on the surface of meats and retarding the growth of mold on bakery products. It offers further possible uses for the sterilizing of conditioned air and the pasteurizing of milk.



An all-electrically welded steel barge on the ways. Note the absence of rivets, the electrically welded seams and the resultant smooth surfaces

A crane cab, in its travel up and down the plant of one of our customers, passes over the top of an open-hearth furnace as well as over a blooming mill. When a heat was being poured from the open hearth or when a bloom was being made the heat and fumes arising from these operations made it almost impossible for the operator to remain in the cab. This condition was remedied by tightly closing the cab and installing a ½-ton air-conditioning unit which cools and filters the air so the operator is comfortable and can devote his entire attention to the safe operation of the crane. No doubt similar applications could be made to advantage in other plants.

"I believe the manufacturing plant which cannot be modernized to some extent is the exception rather than the rule. With the salesman's familiarity and knowledge of the various processes in his territory, he should be able to spot these opportunities and turn them to his own account. Haphazard methods and poorly arranged manufacturing processes cannot successfully meet today's keen competition of a modernized plant."

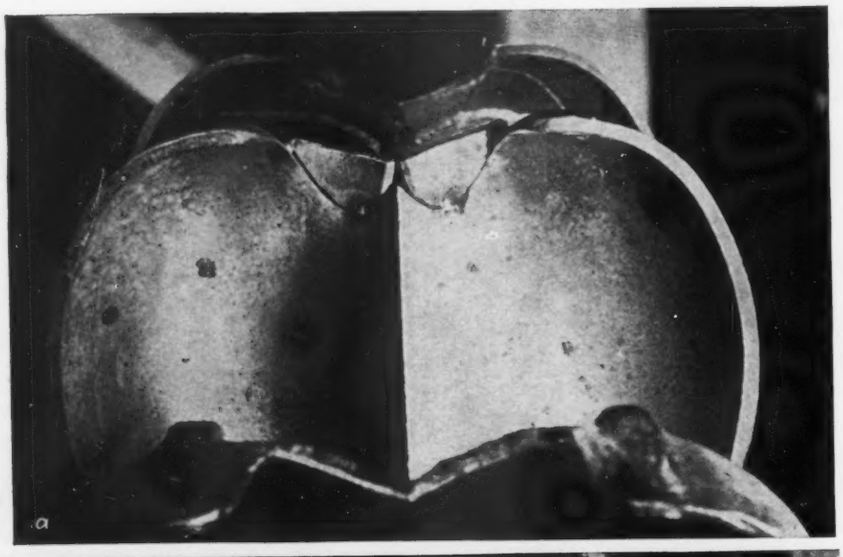
Control room air conditioned

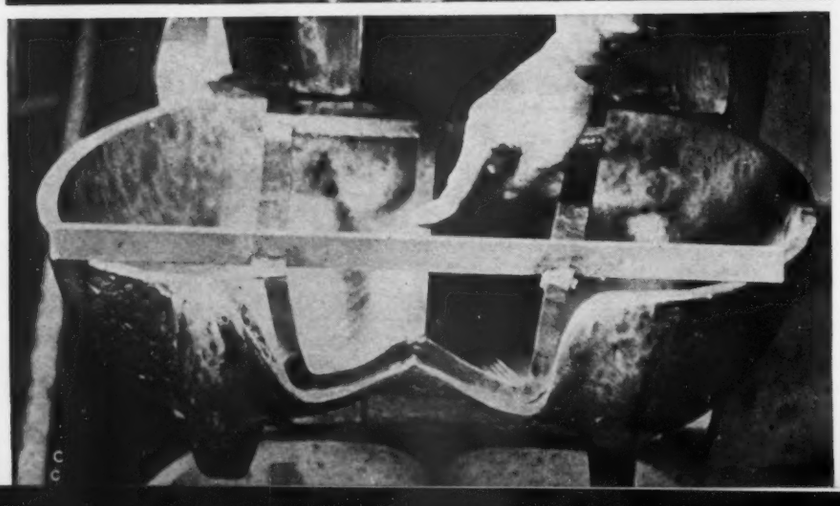
A similar example: The operator's control room in a new blooming mill is completely inclosed and air conditioned. The control room is inclosed on three sides with heavy glass windows so that the operator may have an unobstructed view from one end of the mill to the other. A one-ton refrigerating unit provides cool, filtered air. The comfort it provides allows the operator to give closer attention to the operation of the mill.

It is impossible to discuss in detail all of the illustrations which I might recall, therefore I have attempted, by suggestions, to point out the possibilities for securing new electric load. After all, a great deal depends upon the alertness of the salesman, the frequency of his calls and the extent with which he familiarizes himself with his customers' operations. Certainly a salesman should take every opportunity to suggest to the customer any of the new uses with which he is familiar and which might fit profitably into the customer's operations. If business continues to improve as at present, the time will soon be upon us when the customer will make the excuse that he cannot lose production in order to modernize his plant. When the wheels of industry have reached their maximum speed we can expect expansion, but I firmly believe the time for load building through modernization will then be passed.

Impulse Turbine Repairs

Worn Buckets Built Up, Contours Changed for Improved Efficiency and Large Saving Effected by Field Maintenance Technique — Templates Assist Welders and Finishers





RECENTLY completed was an interesting impulse turbine repair job on one of the Big Creek units of the Southern California Edison Company, Ltd. The penstock of the particular unit is in such a position at the headworks that considerable sand is introduced into the penstock and the turbine proper. Consequently there has been a great deal of maintenance in past years on the bucket splitters due to the abrasive action of this material. Bowl surfaces within the buckets gradually became wavy and large areas were scoured out. When wear in the bowls had reached an advanced stage, it was decided to build up the scoured areas by arc welding during the annual overhaul.

The machine was of an old design having buckets notched at the lip at each side of the splitter, a design intended to allow the buckets to reach a more advanced position on the wheel before cutting into the jet. Later designs have eliminated the notches. It has also been found that eliminating the notches by arc welding has, in some instances, improved efficiency of existing turbines. As the worn buckets were to be strengthened by arc welding against fatigue and break-

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Figs. a and b—Notched in the original design, the bucket repair included filling up the notches to gain efficiency

Curved sections of 10-in. pipe were cut and tack welded as shown on these two views of the front and back of a bucket

Figs. c and d — Uniformity in the rebuilding of the buckets insured

Contour curves were calculated and templates made to guide welders and finishers in building up the metal. In (a) is shown the template used for the inside bucket lips and the extension of the splitter. In (b) the template giving the limiting angle for the back of the lips

Figs. e and f—Bucket welding completed and ready for rough finishing with grinders

Final polishing was done with special flexible emery buffing wheels

Made by Arc Welding

By G. R. WOODMAN
Station Chief, Big Creek Plants 2 and 2A, Southern California Edison Co., Ltd.

age, there was provided an opportunity to fill up the notches on all the buckets in an attempt to improve the over-all efficiency of the machine.

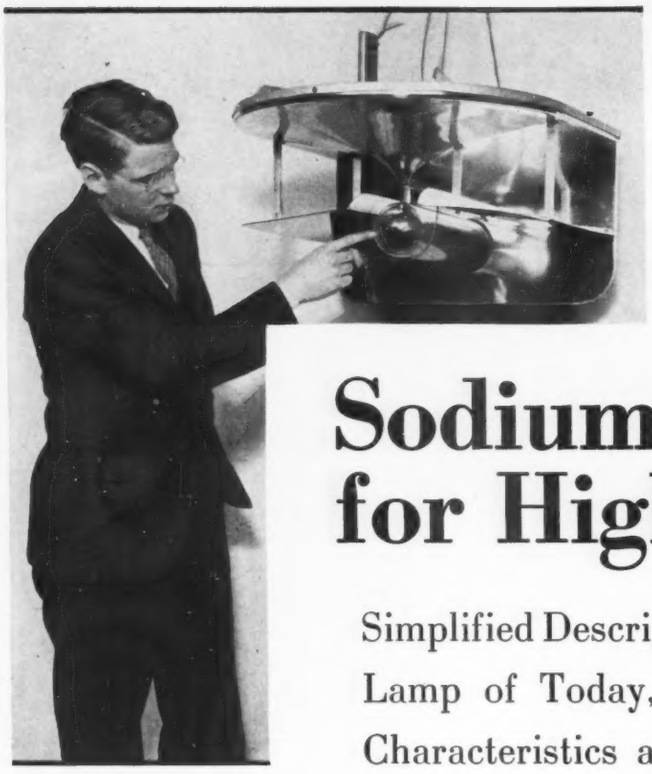
Curved steel filler pieces were cut from 10-in. pipe with an oxyacetylene blowtorch and fitted into the notches as in Figs. a and b. The length of the splitters was increased three-quarters of an inch to take full advantage of possible bowl area and to secure sufficient thickness of the new metal in the tapered section of the lips to give the desired strength to the bowls.

Paths of the bucket lips relative to the jet were laid out in order to determine the limiting angle for the backs of the lips to prevent interference with the jet, loss of efficiency and possible cavitation trouble. Templates for this angle were made and used by both the welders and finishers. The reference surface taken was the machined edge of the bowl. Templates for the inside of the bucket lips and extension of the splitters were also used by both welders and finishers, the machined edges of the bowls being taken for one reference surface and the wheel disks for the other so that the alignment and length of the splitters and the shape of the lips were fixed and uniform. The types of templates used on this job are shown in Figs. c and d. The inside of the bowl was carefully built up to the original thickness and finished to maintain a smooth contour to the lips to prevent later cavitation action.

The procedure employed in the operation was as follows:

Buckets were preheated to about 200 deg. F. with oxyacetylene torches before welding. Care was taken in arc welding to allow time for heat dissipation. Coated mild steel electrodes, 3/16 in. in diameter, were used. After each bead had been placed on the buckets it was peined lightly to remove strains before application of the next bead. Welded areas were rough finished with pneumatic chisels (Figs. e and f), then rough ground with pneumatic high-speed grinders using wheels suitable to the speed and mild steel construction. Finish grind-

[*Continued on page 108*]



By GEORGE A. EDDY

Illuminating Laboratory and Lighting Sales,
General Electric Company, Schenectady, N. Y.

Sodium Luminaires for Highway Lighting

Simplified Description of the 10,000-Lumen Sodium Lamp of Today, Its Construction and Operating Characteristics and Its Application in Luminaires

THERE are now in service or under construction for new installations approximately 3,000 sodium luminaires. If installed at the customary spacing on a single highway this number would illuminate approximately 150 miles. Since the installations are mostly from one-half mile to 17 miles in length, they actually accomplish much more good than would be obtainable from any such single installation, because they provide for the demonstration of attractive highway lighting to motorists and public officials in all parts of the country. The sodium lamp has thereby become recognized in highway lighting practice.

To understand fully the present place of the sodium lamp in highway practice it must be noted that sodium lamps and luminaires are new equipment for highway lighting according to a somewhat conventional technique, but their use does not contemplate any important alterations of that technique. The light distribution from the sodium luminaire and the spacings and mounting heights recommended for it correspond to those of well-known refractor and reflector highway luminaires using incandescent lamps. The trend toward shorter spacings that is observable in highway lighting recommendations is a result of studies to determine what is required for a reasonable uniformity of pavement brightness coupled with suppression of objectionable glare from exposed-source luminaires. Assuming the use of luminaires of equal light output and distribution characteristics at equal spacings and mounting heights, the visibility as affected by *uniformity* and *level* of pavement brightness should be the same for a sodium lighting system as for an incandescent system.

Features of the sodium lamp

Features that have made the sodium lamp desirable are:

1. *High efficiency*—The generation of two or three times as much light as can be obtained from large incandescent lamps for the energy that is consumed.

2. *Low intrinsic brilliancy*—A result of obtaining light from electronic displacement in a large bulb full of vapor instead of from a heated filament.

3. *Distinctive golden color*—About 95 per cent of the light output is produced at two closely related wave lengths falling in that portion of the spectrum to which the eye has been found to be most responsive.

The high efficiency of the sodium lamp has made it seem practical to use 10,000-lumen lamps where formerly 4,000-lumen or 6,000-lumen incandescent lamps were the rule. With about the same energy consumption and a moderately greater investment, it has been found possible to provide a higher level of illumination than heretofore at a rate less than is generally charged for 10,000-lumen incandescent lamps in appropriate luminaires. This is particularly notice-

In June, 1933, the sodium lamp was first used for lighting a public highway in this country. Made possible through extensive research into materials and methods of construction to make the sodium lamp a practical light source, this application carried its sponsors' hopes for more generally attractive and satisfactory highway lighting to come, to be obtainable ultimately at less cost to the public. These hopes are coming to be realized.

able where the service rendered by the utility company covers only the supply of energy or the operation and maintenance of the system, the utility customer owning the equipment.

Lower brilliancy of the sodium equipment has greatly reduced the discomfort glare associated with formerly used luminaires, which feature has been regarded favorably by practically all observers.

A distinctive golden color of the sodium light creates an impression of softness and non-fatiguing quality. It compels generally favorable attention and is therefore of particular value in an installation made as part of a promotional campaign. Of course it is particularly appropriate for an application where the spectacular quality of the lighting is desirable or where the "caution" color will reduce a traffic hazard.

By some the monochromatic light is believed to have advantages for penetrating fog, mist and snow. Without question, a highway lighting system offers benefits in seeing under such conditions. It is a matter of record that users have been impressed with the results obtained from sodium lighting systems; although such tests as have been made under controlled conditions indicate that there is substantially no difference in the penetration of white light and colored light, all other factors being equal. The other factors may not all be equal when comparing two prospective highway lighting systems, but the effect of various factors is so little known as to render a comparison difficult and therefore unsatisfactory. Hence, claims for comparatively better visibility under sodium lighting systems are not readily substantiated. Sufficient to say that an installation, illustrated here, made on the Tacoma-Fort Lewis Highway in the State of Washington for the express purpose of determining if sodium lighting offered benefits under conditions of dense fog has been reported a success.

Details of construction

Simple and reliable equipment, available at reasonable cost and easy to operate and maintain, is obviously necessary to obtain these benefits in practice. Lamps and luminaires that meet these requirements are on the market and are largely responsible for the success achieved so far with sodium lighting.

The lamp used in most of the sodium installations is the 10,000-lumen size, type NA-9. It is a tube using full-wave electronic conduction through sodium vapor solely to produce a useful volume of light (10,000 lumens) when operated at a conventional series circuit current (6.6 amp.). It is a hot cathode lamp, the cathodes being operated in series with the arc, so that external transformers for additional supply power for cathode heating are not required.

Structurally, the sodium lamp consists of a coiled tungsten filament or cathode surrounded by a sleeve of molybdenum, called an anode, one of each of these assemblies being located at each end of a bulb. Leads to the electrode assemblies are coated with inorganic material to prevent attack by sodium. Near the base-end electrode assembly there is a small electrode connected to the tip-end electrode assembly through a high resistance fastened within the lamp base. This is the starting electrode.

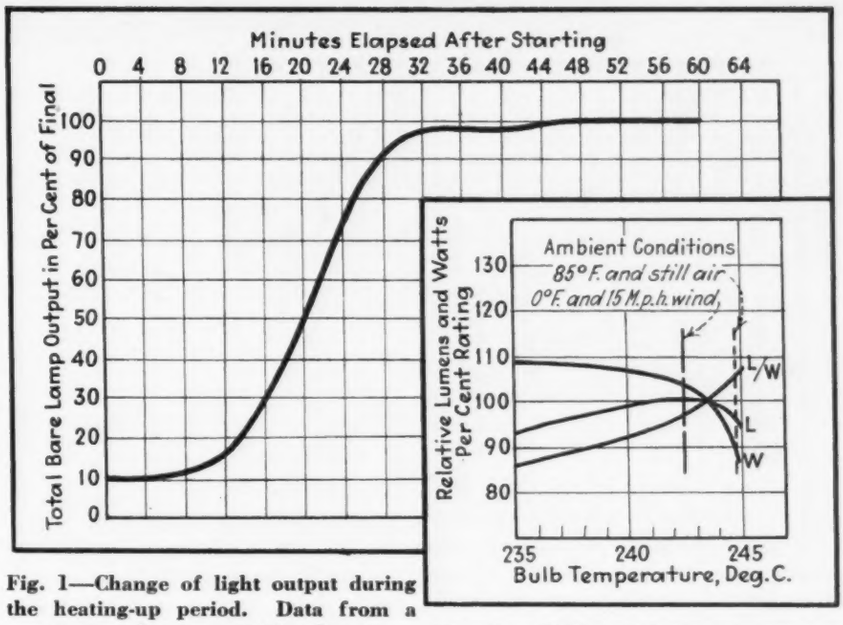

Minutes Elapsed After Starting
0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64
Total Bare Lamp Output in Per Cent of Final
100 90 80 70 60 50 40 30 20 10 0
Ambient Conditions
85° F. and still air
0° F. and 15 M.p.h. wind
Relative Lumens and Watts Per Cent Rating
130 120 110 100 90 80
L/W
L
W
235 240 245
Bulb Temperature, Deg. C.

Fig. 1—Change of light output during the heating-up period. Data from a group of representative lamps

Fig. 2 — Effect of lamp temperature variations when used in vacuum flask

Vacuum flasks required

An insulating jacket is required for the sodium lamp. Its purpose is to store up enough of the heat generated to vaporize the sodium and produce the desired pressure, with least possible effect of ambient temperature variations and wind cooling.

Until recently a vacuum flask used in all cases was a double-wall unit consisting of two clear glass cylinders

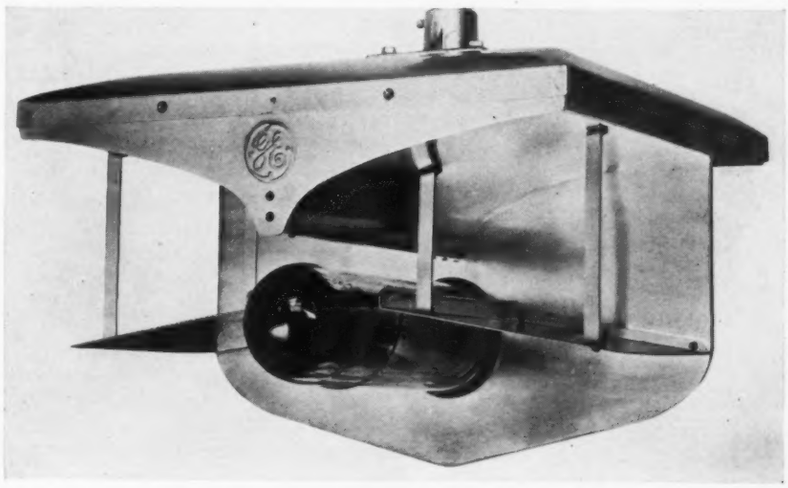


Fig. 3—External view of G.E. Type AM-2 sodium luminaire

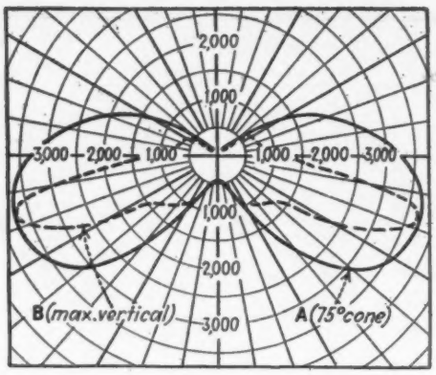


Fig. 4—Light distribution in two planes from Type AM-2 luminaire

sealed together and pumped to a very high vacuum. It was recently found that the addition of a third cylinder produced slightly greater efficiency and less sensitivity to outside conditions. The new three-wall type is now standard for the highway luminaires where the flask is exposed to the elements.

Vacuum flasks are made of clear heat-resisting glass, carefully annealed. The three-wall type, consisting of a double-wall evacuated flask with the additional cylinder or heat baffle inside, is fitted with an aluminum base assembly so that it is readily handled as a unit.

Finally, there is a barium "getter" at the hemispherical end of the flask. Its purpose is to insure perfection of the initial vacuum and maintain it throughout the life of the flask.

Operating characteristics 6.6 amp., 33 volts

Sodium lamps have certain operating characteristics common with practically all arc and glow discharge devices. The voltage required to start the discharge is greater than that required to maintain it. Minimum starting voltage and longest life of cathodes are obtained by preheating them before applying the starting potential. Operating voltage is practically independent of current, so that stabilizing ballast is required to maintain current at the desired value. With sine-wave current the voltage has substantially a rectangular wave form.

The lamp is started by shunting the gap between the electrodes by connecting two of the base pins outside of the lamp. Normal current at 6.6 amp., passing through the cathodes in series for about 20 to 30 seconds, will cause the lamp to start at about 85 volts or less when the external shunt is removed. The average build-up characteristic of a group of representative lamps is shown in Fig. 1.

Sodium lamps operate normally at 6.6 amp. and, except for the instant when the arc is struck, at about 33 volts. The light output will be within a few per cent of 10,000 lumens at normal temperature of about 244 deg. C. Two thousand hours average life and approximately the same lumen maintenance through life as for large Mazda incandescent lamps are to be expected.

Maintaining substantially constant lamp temperature under various ambient conditions is most important to obtaining normal light output and energy consumption. While this is principally in the hands of the vacuum flask designer, a substantially constant current supply is necessary to assure the success of his efforts.

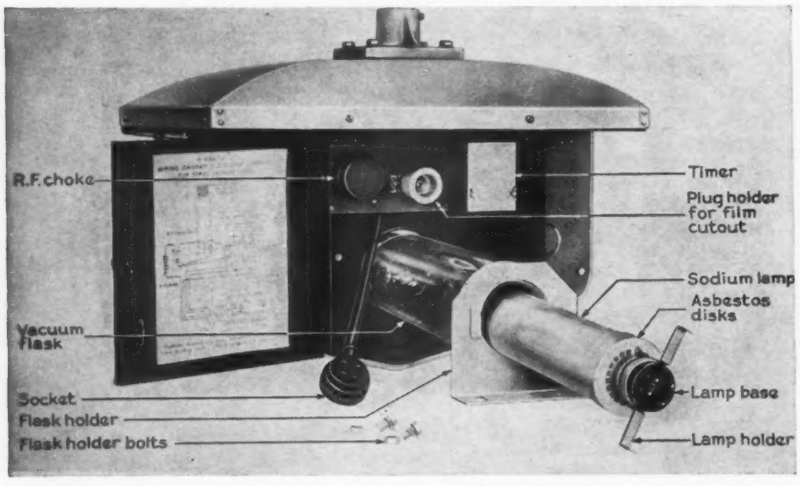


Fig. 5—Rear view of Type AM-2 luminaire showing lamp and vacuum flask withdrawn

Fig. 6—G. E. Form 32-F sodium luminaire, with globe unlatched to show lamp arrangement

The relationships that exist in a typical lamp operating at 6.6 amp. in a No. 71-G three-wall vacuum flask are shown in Fig. 2. It indicates the range that may be expected between the not uncommon external conditions of 85 deg. F. in practically still air and 0 deg. F. with a 15-mile-per-hour wind.

At the 85-deg. ambient temperature in still air it has been observed that current variations of as much as 5 to 10 per cent away from normal produce only about 1 per cent change in lumens output. This is because the light output is a complicated function of current, wattage and bulb temperature. However, abnormally high current may lead to unstable operation and abnormally low current to increased sensitivity to low outside temperature and wind, the characteristic curves for operation at abnormal current being quite changed from those illustrated in Fig. 2 for normal current. To obtain most satisfactory operation current regulation within 2 per cent of normal is recommended.

A normally operating lamp is full of golden-yellow light, of practically uniform brilliancy when viewed from nearby. Spotty or uneven burning indicates too low a lamp temperature and suggests a check-up on the vacuum flask. It should be observed, however, that the new lamp may re-

quire several hours initial burning to distribute the sodium vapor properly.

The usual cause of lamp failure is deactivation of the cathodes. By making the lamp hard to start, this usually causes a complete outage. A lamp that will start reliably can be expected to operate satisfactorily if provided with adequate insulation and proper current. A periodic check-up of cathode preheating timing will insure maximum life of cathodes and also will insure that good lamps are not removed from service prematurely.

A sodium lamp will start at any temperature likely to be encountered in service. In the event of a momentary power interruption, lamps that are used in luminaires equipped with a cathode preheating timer that resets instantly will restart on the expiration of a cathode preheating interval.

Luminaires for sodium lamps

In addition to distributing usefully the light generated by the lamp, the sodium luminaire is required to support the lamp and house its auxiliary equipment in easily accessible fashion. A highway luminaire designed to combine these functions effectively is shown in Fig. 3.

Since the bulk of the light flux from the sodium lamp is emitted from the sides of the lamp, there being very little light at the end zones, a natural effective distribution of light is obtained by mounting the lamp horizontal and transverse to the roadway.

Nowadays there is apparently an increasing interest in and discussion pro and con of "sodium highway lighting." To clarify some of the points now under discussion, a well-informed source was asked to present in simple, concise form the important facts of sodium lighting today. This is done in this article on sodium luminaires and in a succeeding article written about their application to the job.

This luminaire requires only simple cylindrical surfaces of parabolic cross-section to intercept the upward light and reflect it in useful directions along the highway. Because of the relatively large vertical dimensions of the lamp (3 in.), a multiple set of reflectors is used to subtend the light source and gather the upward light. As will be seen from an examination of the light distribution curves (Fig. 4), this luminaire is well adapted to highway lighting at conventional spacings and mounting heights, most particularly for the three- and four-lane highways. High efficiency is obtained from the use of polished Alzak aluminum reflector surfaces, which material has about 80 per cent coefficient of reflection and excellent durability when exposed to the weather.

Within the compartment (Fig. 5) a bracket-type holder for the vacuum flask is mounted. It is securely bolted to the bottom of the compartment, since once installed it will be removed only occasionally for cleaning. The lampholder attaches the flaskholder and positions the lamp within the vacuum flask without strain on the various parts, and provides for its easy removal.

A well-known and popular incandescent lamp luminaire has been equipped with the sodium lamp and auxiliary equipment in response to a demand for a type of luminaire that could be used in small numbers for lighting grade crossings, intersections, underpasses or other hazardous points wherein it is desired not only to illuminate the danger point but also to provide a distant warning of its presence. This is illustrated in Fig. 6. The luminaire produces a symmetrical distribution of light. A pronounced unsymmetrical distribution is not obtainable because reflectors of adequate size are too large to be inclosed in the globe. This is the first of two articles on the place of the sodium lamp in highway lighting. The next will appear soon.

Tacoma-Fort Lewis Highway lighted with 10,000-lumen sodium lamps in G.E. Novalux reflector luminaires at 232-ft. staggered spacing

Testing Set of 350 Kv. for High-Voltage Research

Los Angeles Bureau of Power and Light Adds New Facilities to Permit Research in High-Voltage Operating Problems—Compactness and Safety Features of Modern Design and Equipment

By T. M. BLAKESLEE
Los Angeles Bureau of Power and Light, Los Angeles, Calif.

BELIEVING that any utility should have voltage-testing facilities equal to, and preferably exceeding, its highest transmission line voltage, the testing laboratories of the Los Angeles Bureau of Power and Light have installed a 350,000-volt testing set. The set is made up of the main high-voltage transformer, induction regulator and control table made by the General Electric Company. An auxiliary step-down transformer made from existing material with circuit breaker equipment furnished by Kelman Electric & Manufacturing Company complete the bulk of the apparatus. A general view of the equipment as installed is shown in an accompanying illustration.

The main transformer delivers 350 kv., is rated continuously at 1,000 kva. O.I.S.C. and has an impedance of only 3 per cent. This is unique in that the unit is only about two-thirds of the physical size of the units at Ryan Laboratory, Stanford University (installed in 1926), which have the same output voltage with a non-continuous rating of 350 kva.

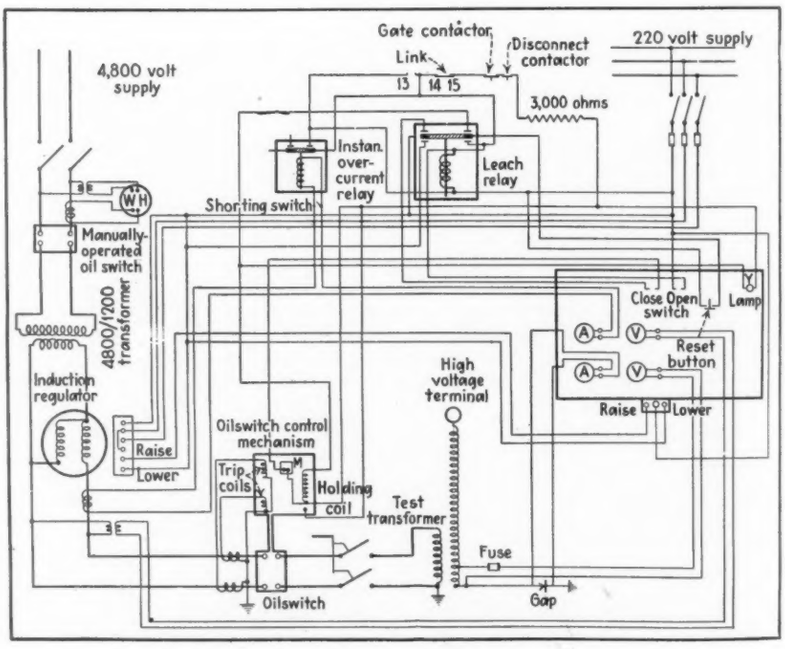
Two of the features which allow the high continuous rating of the new transformer are the radiators with which it is equipped and the oil-filled bushing rated at the full voltage output of the transformer. The transformer is designed to be the top unit of a three-unit chain connection to develop 1,050 kv. should the bureau ever see fit to increase its voltage-testing equipment.

The bushing shield serves as the oil expansion tank for the complete transformer and is provided with sight glasses and a breather. As the ceiling height in the testing laboratories building is limited, the transformer is installed in a pit so as to bring the top of the tank level with the floor and thereby obtain the required clearance for the bushing terminal.

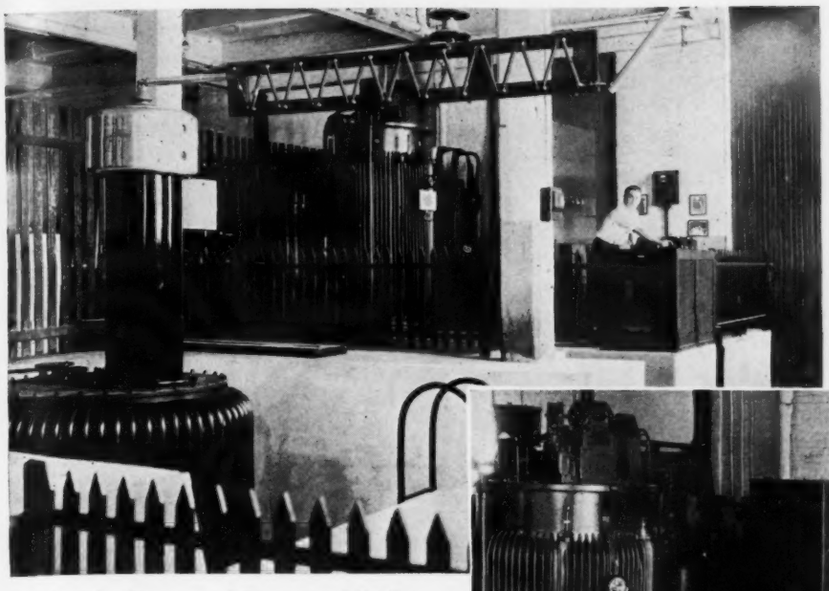
A split primary winding provides for either 2,400- or 4,800-volt excitation. The induction regulator used to control the transformer voltage is rated 500 kva. at 1,200 volts, 100 per cent raise and lower. Thus it will deliver full capacity to the test transformer and provides full control for either 0 to 175 kv. or for 0 to 350 kv., depending upon the primary connection of the test unit. The regulator is motor operated and is controlled from the control table of the test set.

Insulated from delta supply

A special 4,800-volt service through regular disconnects and a hand-operated oil breaker supplies power to the test set. To supply the 1,200-volt regulator, a 4/1, 1,000-kva. transformer is provided. This transformer also serves to insulate the test set supply from the service power, thereby enabling the primary of the test transformer to be grounded without disturbing the ungrounded 4,800-volt delta distribution system.

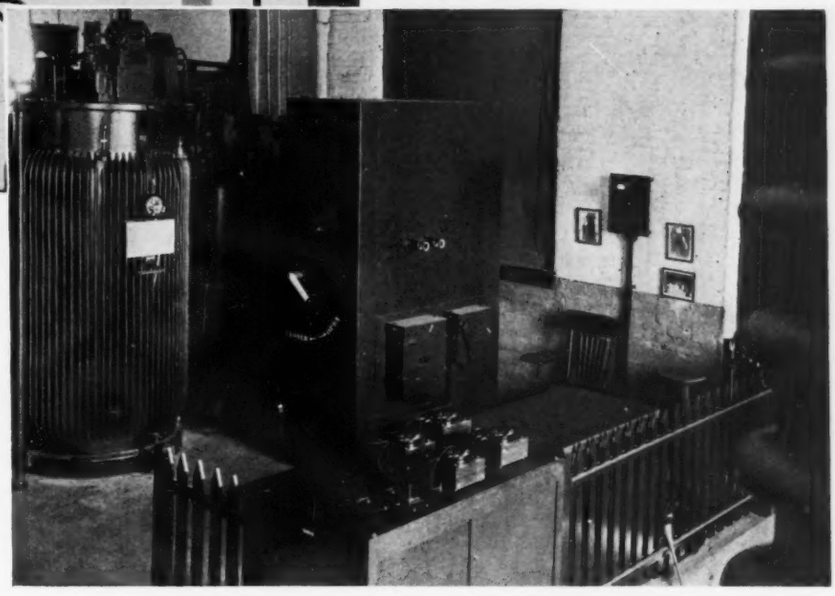


High-voltage test set has distinctive method of connecting regulator in circuit



Service breaker, remote-operated breaker and both sets of disconnects are inclosed in a steel cabinet

Service disconnects are pole operated, but the disconnects in the test transformer primary circuit are lever operated from the outside of the cabinet. Since it is these latter disconnects which give clearance to the operator to work on the test transformer high-voltage circuit, the open and closed positions are plainly marked at the lever. To give protection against the contingency of a broken insulator in the lever system indicators have been provided on the front of the cabinet in the form of fiber rods which bear on the actual disconnect blades.



Los Angeles Bureau of Power and Light installs 350-kv. test set

Transformer sunk into pit to give adequate clearance. Full capacity resistor. Regulator and controls installed on elevated platform to give operator clear view of test area.

A remote-operated breaker controlled from the control table and a set of disconnects are provided in the regulator output and these are used in the normal operation of the set.

The control table provides switches for operating the test transformer, primary oil breaker and the regulator. The customary indicating lights are also included. Space and terminals are provided on this board to connect portable meters to read the regulator output voltage and current and the test transformer output voltage and current. The regulator meters are operated from instrument transformers. Test transformer output voltage is obtained from the potential across $12\frac{1}{2}$ turns on the grounded end of the high-voltage winding; the total number of turns on this winding is 12,500, giving a 1,000 to 1 ratio. The ammeter indicating transformer output current is connected across a gap in the grounded end of the high-voltage winding.

Ordinarily a high-voltage testing set incorporates considerable reactance, so that, although full voltage is delivered at the terminals for no current flow, when arcover of the test specimen or of the test gap occurs an appreciable drop, usually in the order of 50 per cent, takes place in the transformer and its appurtenances. The remainder of the drop is ordinarily handled by a protective resistor in series with the transformer output.

Because of the extreme low reactance of this transformer and its associated regulatory equipment, plus the fact that power is received from a practically infinite bus, arcover of the test specimen or gap puts practically full voltage across the transformer protective resistance. A resistor made up of rods which will stand a red heat is used and special care is taken by low setting of the tripping relays to insure minimum actual arcover time. This resistor is designed to withstand full 350 kv. Although this low impedance appears as a disadvantage in the light of the above, it is some satisfaction to know that ample capacity is available should any test require it, and what test engineer has not, at some time or another, been balked by the capacity limitations of his test equipment?

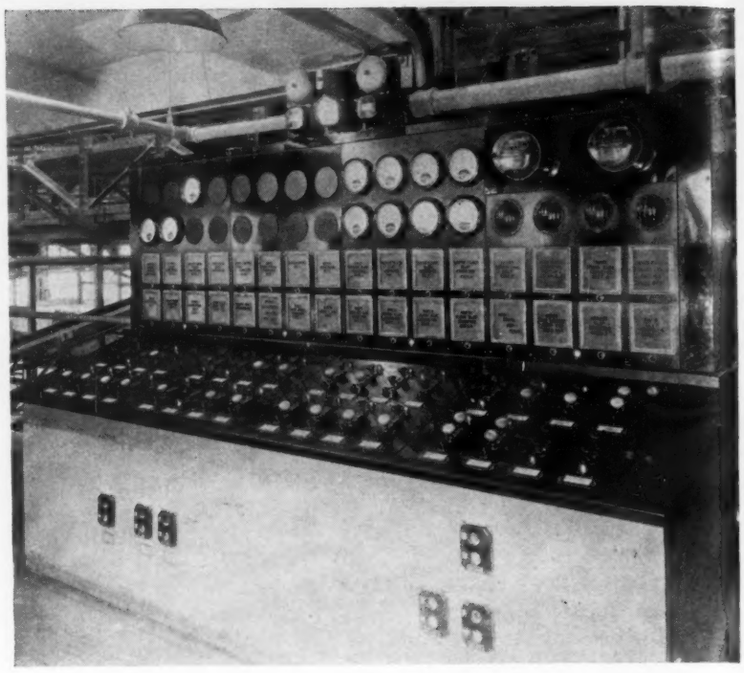
Special control features provided

All the control circuits operate from the regular 240-volt supply in the laboratory building. Since this supply is separate from the special 1,000-kva. service for the test set, the remote-operated breaker is provided with a no-voltage trip coil which insures tripping should the control supply fail independently of the test service.

A small auxiliary terminal and relay board has been installed by the bureau directly underneath the control bench supplied with the set. Terminals on this board provide easy access to all metering and control circuits to simplify connections for special set-ups. Ample space is provided on this auxiliary panel for mounting special relays. An instantaneous overcurrent relay which may be easily adjusted to trip the set over a wide range of currents has been mounted on this panel. This obviates the necessity of continually altering the setting of the regular trip coils mounted in the oil breakers themselves. The latter furnish very satisfactory backup protection.

Control circuits are arranged such that opening the test transformer breaker will automatically run the regulator to the maximum buck position. This prevents the operator from energizing the test transformer

[*Continued on page 108*]



Centralized control over 32 conveyors is provided by this bench-type switchboard
Signals from the warehouse advise the operator of desired movement. At the right end signal lamps operating in conjunction with photo-cell actuated time-delay relays permit regulation of the loading of main conveyor units

Centralized Operation of Conveyor Units Increases Flexibility of System, Minimizes Delays Due to Pile-ups and Lowers Costs of Warehouse Movements — Photo-Cell Counters Regulate Capacity Being Handled

Central Conveyor Control Expedites Product Handling

By H. A. DELIUS
California & Hawaiian Sugar Refining Corporation, Ltd., Crockett, Calif.

IN CONNECTION with its refining operations at Crockett, the California & Hawaiian Sugar Refining Corporation, Ltd., maintains a warehouse covering more than seven acres of ground area capable of storing 135,000 tons of raw and refined sugar. Most of this area is of single-story construction and here sugar is stacked in piles 40 bags high.

To handle the sugar into and out of storage with a minimum of manual labor an elaborate system of conveyors has been provided by means of which a bag of sugar can be carried to practically every corner of the house. There are in all 32 conveyors of different types, ranging in length from 25 to 800 ft. Each conveyor normally is a part of a chain, a single chain often including as many as nine different units. Any one of the conveyors taking part in such a chain can be stopped by an overloaded condition of its driving motor or by means of the emergency stop buttons placed at intervals along its path for safety purposes. The confusion resulting from such a stoppage if all the conveyors preceding the stopped unit were not immediately brought to rest can readily be imagined. To avoid such a condition a central control station was installed consisting of a bench-type switchboard, from which all of the warehouse conveyors can be started and stopped.

On the bench portion are the control buttons for each of the conveyor motors with their indicating lights. The knobs of the buttons are fitted with identifying caps to show the operator at a glance which units belong to the different chains in use at that time. On the lower half of the vertical portion are the transparencies used for signaling purposes. When the emergency stop button of a conveyor is operated or the motor kicks out from an overload a red light lights up behind the transparency of the unit involved. At the same time a gong sounds, calling the operator's attention to the situation. His duty is then to stop immediately all conveyors feeding this unit. Due to the rapidity with which bags pile up under these conditions, the operator must be constantly on the alert to eliminate blockades and their resulting confusion. Recently the motors comprising two of the chains used most frequently were all interlocked electrically to reduce the time required to stop them to a minimum. It would not be practical to extend this to all of the conveyors as the number of combinations that are required to meet the various warehousing operations are so large that the system would be unwieldy.

Transparencies used for signaling

The transparencies are also used for signaling from the various points of the conveying system to the control station operator. When one of the warehouse foremen wishes a particular conveyor started he presses one of a series of push buttons located conveniently along its length, to give

[*Continued on page 108*]

Load-Building Progress in the Year 1936

A Study of the Merchandising Activities of 133 Power Companies — What They Sold — What They Gained By It

Power companies continue to forge ahead in domestic load building. Here is the evidence, in reports from systems serving 14,516,558 domestic consumers throughout the country. Of them 110 sell appliances, 23 do no merchandising themselves. In both groups dealer sales are estimated and show remarkable strides in selling the major load appliances. A study of these tabulations discloses many interesting comparisons of the methods and accomplishments of the different utilities and should prompt considerable self-analysis. New figures on the cost of selling are introduced this time, and there are signs that this semi-annual analysis is leading to much-needed improvement in selling practice. This is the seventh semi-annual survey in the series.

TWO interesting developments mark the year 1936 in the field of domestic load building. Power companies increased the speed with which they have been expanding their sales activities. They showed, in dollar total, a 22 per cent growth in merchandise sold over the year 1935, whereas the similar survey for 1935 showed a 21 per cent increase over 1934. This sustained acceleration—bigger gains on top of bigger gains—is no mean achievement. This increased the average annual domestic consumption for the companies reporting by 11 per cent. To do this they employed 18 per cent more sales personnel.

Second in interest, the Southeastern companies continue to lead the field. They have chalked up the records for largest gains in average annual domestic consumption, largest appliance sales per consumer, largest revenue per consumer, lowest number of consumers per sales person and largest sales of refrigerators, ranges and water heaters per 1,000 consumers. The record for highest average annual domestic consumption remains on the Pacific Coast, in so far as a system average is concerned.

However, a local subsidiary of a large system, an operating company that does not merchandise, rose above that record and set an all-time high of 1,970 kw.-hr. per domestic customer. But on June 30, 1936, the parent company reported an average for the entire system of 805 kw.-hr.

Record for the highest average refrigeration saturation shifted from the Southeast to the central area last year. The Coast continues to record the lowest average domestic rate and the highest range and water heater saturations.

The story is told in detail in the following pages, presenting the experience of 133 power companies, serving a total of 14,516,558 domestic consumers. Of these companies, 110 are actively selling load-building appliances to a total of 12,077,674 households and 23 companies do no merchandising themselves. The latter depend on the local dealers to sell the equipment needed by the 2,438,884 families they serve. And the dealers are steadily increasing their sales also. Not the least interesting feature of this survey is the fact that so large a gain is reported in utility sales, when dealers' volume has also swelled so greatly.

The 110 power companies that sell appliances operate in communities ranging in size from 785,900 down to 3,465 domestic customers and the total number of residence consumers was 4 per cent more than the year before. Their sales of appliances of all kinds totaled $81,431,199 in 1936, against $66,575,750 in 1935. In terms of

Sales methods continue to improve, more display, more demonstrations and out of it all more load

Domestic Appliance Sales by Power Companies

Table I— Total sales of household appliances by 11 power companies during the full year 1936, together with estimates of dealer sales of refrigerators, ranges and water heaters in the same areas.

Company	Total Domestic Consumers December 31	Average Annual Domestic Kw.-Hr. Consumption		Average Revenue per Consumer	Av. Costs for Domestic Service—Cents	Refrigerators Units Sold By Power Cos.		Refrigerators Units Sold By Dealers Pwr. Co. Est.		Saturation Refrigerators Percent	Ranges Units Sold By Power Cos.		Ranges Units Sold By Dealers Pwr. Co. Est.		Saturation Ranges Percent	Water Heaters Units Sold By Power Cos.		Water Heaters Units Sold By Dealers Pwr. Co. Est.		Saturation Water Heaters Percent
	1936	1936	1935	1936	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																				
1	785,900	806	792	$34.58	4.25	4,965	5,661	.....	.....	43	17	8	.....	.....	.....	.....	.....	.....	.....	.....
2	[H] 756,894	595	544	.....	.....	6,968	5,351	.....	.....	.....	237	121	.....	.....	.....	32	7	.....	.....	.....
3	[H] 612,905	690	617	32.18	4.66	.....	.....	45,069	36,000	35	10,018	7,423	2,580	1,365	9	3,294	3,352	679	296	2
4	[H] 557,158	793	718	34.88	4.40	4,935	5,661	54,065	44,107	50	[C] 6,064	[C] 5,823	1,378	675	5	[D] 4,320	[D] 2,483	270	191	2
5	[H] 529,474	823	761	31.66	3.85	2,705	1,127	.....	.....	35	9,947	4,875	.....	.....	8	719	29	.....	.....	.....
6	[H] 521,904	545	510	32.56	5.97	6,563	5,697	.....	.....	.....	3,332	2,848	.....	.....	.....	160	132	.....	.....	.....
7	324,944	675	643	35.30	5.23	3,711	2,655	37,000	26,000	35	1,669	1,323	750	500	4	247	147	.....	.....	.....
8	[H] 318,108	609	554	35.99	5.91	3,509	3,283	15,377	11,100	38	3,074	2,088	1,048	528	6	774	615	185	95	1
9	[H] 308,957	849	726	29.49	3.47	11,808	7,247	.....	.....	40	7,648	4,738	9,007	3,922	17	2,000	1,191	790	316	2
10	[H] 293,251	842	788	35.36	4.20	2,050	1,676	33,000	26,000	51	6	9	125	120	1	.....	.....	.....	.....	.....
11	[H] 259,255	762	715	40.30	5.40	5,298	2,213	17,500	.....	50	549	433	.....	.....	.....	157	195	.....	.....	.....
12	[H] 236,539	842	794	35.19	4.18	2,760	2,821	.....	.....	.....	[C] 1,006	[C] 836	.....	.....	.....	211	314	.....	.....	.....
13	[H] 210,265	816	728	28.96	3.55	1,286	1,082	25,715	21,300	53	[C] 653	[C] 463	63	39	[A] 11	[D] 121	[D] 57	14	4	[A] 1
14	206,979	823	816	28.50	3.46	1,148	680	9,102	5,820	25	1,044	751	1,115	712	5	[D] 598	433	312	232	1
15	166,231	866	748	31.93	3.69	6,604	4,692	.....	.....	35	4,337	2,729	999	416	11	1,105	845	49	21	2
16	164,766	813	751	34.97	4.30	3,529	2,652	7,500	5,900	35	1,087	1,298	.....	.....	4	148	181	.....	.....	.....
17	[H] 144,881	548	502	28.75	5.25	3,053	2,053	.....	.....	.....	1,500	885	.....	.....	.....	495	23	.....	.....	.....
18	[H] 135,814	821	736	42.26	5.15	4,836	3,941	4,500	3,200	42	1,858	1,475	450	300	8	[D] 841	[D] 651	150	100	3
19	[H] 120,589	528	478	32.11	6.09	2,576	1,677	4,158	3,404	22	1,870	1,482	169	84	9	655	650	18	7	1
20	[H] 114,949	639	587	32.37	5.07	2,389	1,541	11,926	9,031	.....	265	169	.....	.....	.....	143	127	.....	.....	.....
21	[H] 97,945	697	647	42.30	6.06	1,468	1,514	975	1,000	.....	9	3	.....	.....	.....	2	.....	.....	.....	.....
22	[H] 94,074	672	590	30.32	4.51	1,660	807	6,000	5,325	.....	1,040	524	683	187	.....	17	1	.....	.....	.....
23	[H] 93,943	649	577	39.31	6.06	182	392	6,499	6,159	32	124	268	1,497	1,105	6	152	479	572	531	2
24	[H] 79,383	683	633	46.02	6 74	2,693	2,292	3,750	3,500	38	745	501	100	50	6	287	194	10	10	1
25	76,024	753	688	38.12	5.19	5,852	4,283	2,750	2,500	52	[C] 439	224	10	10	3	24	6	.....	.....	.....
26	[H] 69,329	646	563	35.24	5.45	1,560	1,135	2,449	1,736	22	1,169	964	176	105	9	998	852	114	82	4
27	[H] 67,448	597	538	33.22	5.57	1,275	1,259	1,901	1,544	.....	1,024	14,442	67	53	.....	426	352	12	3	.....
28	[H] 66,741	629	571	32.50	5.17	387	207	.....	.....	.....	562	418	.....	.....	.....	14	22	.....	.....	.....
29	[H] 56,241	572	531	32.15	5.62	1,455	1,104	1,414	1,439	.....	895	932	334	213	.....	133	76	4	1	.....
30	[H] 55,259	687	634	35.91	5.23	2,798	1,786	4,000	3,500	.....	1,166	915	250	150	.....	171	67	.....	.....	.....
31	[H] 52,785	623	588	36.09	5.79	856	580	2,250	1,950	42	391	342	425	150	12	47	43	2	.....	.....
32	[H] 52,006	860	750	33.11	3.85	2,360	1,952	.....	1,600	44	984	368	29	5	6	228	211	19	6	1
33	[H] 49,752	649	584	37.41	5.76	1,272	1,105	3,437	1,979	32	572	462	117	77	4	375	333	61	24	2
34	[H] 42,979	453	420	[B] 29.81	6.58	1,117	1,015	1,420	1,338	29	125	103	26	34	2	15	3	.....	.....	.....
35	[H] 41,971	605	567	33.59	5.56	662	636	1,489	1,764	24	577	576	110	36	7	158	47	21	.....	2
36	[H] 40,773	732	656	42.29	5.77	50	54	2,473	2,624	41	57	100	1,160	1,168	15	36	70	267	295	2
37	39,543	687	644	42.28	6.10	1,286	1,316	2,820	2,970	58	250	480	112	98	10	6	4	.....	.....	.....
38	[H] 39,166	676	701	29.70	4.17	549	421	1,085	800	.....	[C] 320	[C] 235	.....	.....	.....	[D] 217	[D] 143	.....	.....	.....
39	38,546	748	641	32.67	4.37	1,866	997	465	.....	33	859	560	43	29	6	126	97	3	2	1
40	[H] 36,542	426	396	22.86	5.35	340	232	1,615	1,600	.....	10	9	39	24	.....	.....	.....	.....	.....	.....
41	[H] 36,380	694	633	36.09	5.20	1,465	[E] 1,127	1,500	1,000	35	[G] 65	[G] 7	[G] 25	[G] 15	[G] 10	9	1	3	.....	.....
42	35,115	698	645	34.93	5.01	294	[E] 292	2,081	1,721	25	[C] 625	[C] 754	347	257	15	[D] 117	[D] 66	16	11	2
43	[H] 34,502	577	500	29.90	5.20	1,678	1,166	1,500	.....	30	698	357	90	.....	13	208	123	15	.....	1
44	[H] 33,019	503	479	27.19	5.39	888	622	.....	.....	10	5	3	.....	.....	.....	.....	1	.....	.....	.....
45	[H] 32,219	589	535	43.62	7.39	320	193	1,000	579	.....	94	36	20	30	.....	33	9	2	2	.....
46	[H] 31,009	758	690	41.12	5.43	597	478	2,600	2,300	.....	105	72	45	35	.....	16	14	3	3	.....
47	[H] 28,120	698	625	31.19	4.48	742	399	.....	.....	.....	345	238	54	49	.....	46	38	.....	.....	.....
48	[H] 21,697	673	573	31.32	4.68	659	509	2,324	2,300	55	16	14	7	3	.....	.....	.....	.....	.....	.....
49	19,767	655	575	28.33	4.33	59	.....	3,000	2,500	.....	113	7	410	75	.....	19	1	64	5	.....
50	[H] 17,095	574	536	31.23	5.40	392	274	521	565	.....	211	207	66	44	.....	26	20	.....	.....	.....
51	13,491	575	544	35.29	6.13	195	116	744	562	38	11	7	.....	.....	.....	.....	.....	.....	.....	.....
52	12,868	566	513	32.04	5.60	124	88	373	266	16	248	183	88	50	11	66	74	18	2	3
53	[H] 8,070	572	530	31.16	5.40	77	86	227	219	20	126	91	16	12	11	49	26	6	2	1
Total	8,283,565	[Y] 677	[Y] 619	[Y] 34.15	[Y] 5.13	117,871	90,147	327,574	247,202	[Y] 36	70,161	64,179	24,030	12,725	[Y] 8	20,041	14,805	3,679	2,241	[Y] 2
II—SOUTHEAST—South of Ohio River, East of Mississippi River																				
54	143,520	1,183	1,039	39.87	3.37	7,123	[E] 8,740	.....	10,100	63	6,646	[C] 4,932	.....	300	19	3,965	[D] 2,982	.....	100	7
55	[H] 135,932	780	712	32.80	4.20	7,063	5,182	.....	.....	.....	2,943	1,499	.....	.....	.....	901	376	.....	.....	.....
56	109,629	1,176	967	36.71	3.13	7,708	6,948	.....	.....	51	[C] 5,064	[C] 4,925	1,794	1,162	23	[D] 2,801	[D] 2,242	449	249	7
57	95,981	1,118	990	36.68	3.31	7,085	6,974	.....	8,800	35	3,411	2,603	947	397	24	1,804	1,145	286	150	2
58	[H] 88,948	1,016	899	56.45	5.56	333	378	17,192	15,686	50	927	976	3,965	2,918	20	573	639	1,999	1,453	12
59	[H] 72,923	671	619	33.73	5.03	1,836	1,519	5,000	3,500	44	113	66	10	10	2	9	6	.....	.....	.....
60	[H] 67,112	584	517	33.29	5.70	1,272	851	4,939	3,696	.....	940	798	241	199	.....	306	270	55	38	.....
61	65,824	1,010	858	38.76	3.84	1,241	3,073	8,038	4,429	47	1,775	2,207	1,011	158	20	993	1,080	277	40	6
62	56,149	684	599	28.69	4.19	484	736	7,522	6,991	52	77	7	150	56	2	6	1	25	.....	.....
63	[H] 32,508	693	654	39.10	5.60	424	596	4,063	3,597	46	302	241	199	203	6	108	91	56	26	3
64	30,835	628	562	39.56	6.30	737	955	660	1,427	33	[C] 703	[C] 862	45	.....	10	[D] 402	[D] 266	.....	.....	4
65	[H] 27,366	596	547	33.63	5.00	467	472	2,368	2,102	40	275	149	144	86	7	13	10	6	3	.....
66	28,870	758	655	35.48	4.68	1,807	1,729	.....	1,500	38	376	509	.....	.....	4	269	337	.....	.....	10
67	23,190	836	743	45.55	5.04	940	931	1,096	.....	50	497	581	170	.....	14	531	579	154	.....	11
68	18,565	1,072	916	40.06	3.74	955	1,094	.....	.....	50	456	363	.....	.....	17	317	267	.....	.....	7
69	15,540	930	857	39.37	4.20	[N] 223	[N] 168	1,200	1,800	38	[C] 346	[C] 311	32	8	16	[D] 162	[D] 84	3	1	4
70	[H] 13,966	819	729	38.22	4.66	643	535	1,357	1,627	51	140	217	169	102	7	54	63	39	11	1
71	[H] 12,782	564	525	35.79	6.00	598	589	492	.....	43	188	96	5	.....	6	109	27	.....	.....	2
72	[H] 12,159	968	805	49.34	4.95	126	424	1,035	1,203	62	103	283	225	374	20	53	142	127	160	10
73	10,915	991	811	43.38	4.38	805	401	745	1,047	52	509	[C] 305	70	37	18	[D] 367	[D] 269	43	17	.....
Total	1,062,714	[Y] 854	[Y] 750	[Y] 38.82	[Y] 4.64	41,870	42,295	55,707	67,505	[Y] 47	25,791	21,930	9,177	6,010	[Y] 13	13,743	10,876	3,519	2,248	[Y] 8

[A] In non-gas territory only. [B] Rate reductions in 1936. [C] Rent ranges. [D] Rent water heaters. [E] Rent small refrigerators. [F] Includes E. A. R. on refrigerators sold by dealers. [G] Rural only. [H] Operate some gas service also. [I] Budget figures. [J] No longer selling. [K] Outside salesmen only. [L] Salesmen sold both gas and electric for eight months. [M] Includes company and dealers. [N] After April 1 [O] Includes all advertising. [P] Excludes appliance servicing. [Q] Includes dealer sales financed by com-

and Local Dealers for the Full Year 1936

Also, comparisons of these sales totals with the year 1935, with data on average consumption, rates, revenues, saturations, sales totals, sales people and direct sales and promotional expense in building domestic load — embracing over twelve million consumers.

Clothes Washers Units Sold By Power Cos.		Saturation Clothes Washers Percent	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines Percent	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners Percent	All other Appliances Units Sold By Power Cos.		Total Sales of All Appliances By Power Cos.		Power Co. Appl. Sales Per Consumer	Annual Revenue Increase from Power Co. Sales	Number Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Direct Sales Expense	Power Co. Advertising & Promotion Exp.	Sales & Adv. Expense Per Consumer	Company
1936	1935	1936	1936	1935	1936	1936	1935	1936	1936	1935	1936	1935	1936	1936	1936	1935	1936	1936	1936	1936	
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																					
4,029	3,146	50	1,467	1,008	6	5,727	4,085	79	163,036	117,423	$4,470,804	$3,596,139	$5.69	$541,419	625	670	1,257	$1,958,817	$497,318	$3.13	1
11,431	7,335	.....	2,538	1,528	.....	6,601	5,330	.....	67,145	55,635	3,619,514	2,376,359	4.78	.....	363	294	2,085	.....	.....	.....	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,696,619	1,293,380	2.77	[F]1,491,300	200	180	3,065	.....	[I]105,838	.....	3
3,335	3,170	45	765	817	2	1,399	1,023	74	39,240	45,776	2,286,119	2,226,943	4.11	617,860	212	216	2,628	.....	236,928	.....	4
[J]51	849	.....	296	275	.....	[J]378	657	.....	50,544	38,525	1,857,000	934,000	3.58	.....	66	40	8,022	.....	508,000	.....	5
4,820	3,738	.....	1,046	969	.....	3,158	2,811	.....	[J2],500	30,700	2,576,000	2,099,133	4.94	749,436	215	.....	2,427	.....	.....	.....	6
2,266	1,800	24	449	272	2	2,578	1,397	57	42,196	28,311	1,472,357	1,062,037	4.53	.....	[K]49	[K]34	6,632	.....	.....	.....	7
3,199	2,044	85	536	332	1	1,358	790	60	21,706	14,886	1,860,250	1,426,825	5.85	315,577	421	447	756	755,458	149,731	2.85	8
4,116	3,076	.....	1,283	852	.....	3,033	2,957	.....	.....	.....	3,615,426	2,417,989	11.70	.....	531	425	582	.....	.....	.....	9
2,245	2,620	61	891	1,202	16	1,782	1,729	64	19,427	18,442	1,114,100	978,155	3.80	176,012	44	40	6,665	154,394	20,479	.60	10
2,219	2,770	.....	614	553	.....	2,189	2,220	.....	45,148	38,369	1,585,389	1,127,554	6.12	179,320	[L]100	68	2,592	.....	120,000	.....	11
2,978	3,162	.....	315	106	.....	2,376	2,007	.....	19,700	17,202	1,521,707	1,491,975	6.43	.....	213	190	1,111	.....	.....	.....	12
1,044	1,019	53	281	278	6	3,471	1,544	54	64,793	35,708	746,063	623,438	3.55	56,000	107	98	1,965	.....	.....	.....	13
1,083	1,367	.....	96	101	.....	1,715	1,229	.....	28,600	23,500	945,000	754,000	4.57	150,000	71	55	2,915	.....	.....	.....	14
3,019	2,879	.....	1,153	1,221	.....	1,922	1,515	.....	.....	.....	2,630,449	2,054,411	15.82	.....	265	250	627	.....	.....	.....	15
1,334	1,585	85	445	362	4	1,352	1,060	.....	.....	.....	1,289,000	1,108,000	7.82	156,000	139	126	1,185	136,900	70,400	1.26	16
1,039	1,060	.....	178	86	.....	1,085	929	.....	.....	.....	1,026,014	648,994	7.08	120,890	100	70	1,449	.....	69,766	.....	17
1,153	1,133	72	371	275	11	528	460	80	29,325	27,761	1,828,713	1,526,673	13.46	.....	103	83	1,319	301,123	72,418	2.75	18
578	724	.....	124	109	.....	.....	.....	.....	.....	.....	915,918	686,926	7.60	173,571	103	97	1,171	.....	54,018	.....	19
383	390	.....	55	92	.....	679	463	.....	.....	.....	575,856	403,297	5.01	[M]304,660	46	46	2,499	161,398	56,105	1.89	20
266	456	.....	88	196	.....	260	358	.....	2,999	1,950	320,007	358,610	3.27	.....	36	30	2,721	.....	.....	.....	21
285	242	.....	114	44	.....	153	91	.....	4,712	3,250	655,070	338,660	6.96	.....	[N]133	46	707	.....	[O]54,587	.....	22
48	55	50	26	18	4	.....	.....	.....	.....	.....	113,036	178,466	1.20	400,929	21	32	4,473	222,513	27,000	2.66	23
769	833	43	187	175	.....	806	916	58	5,129	2,833	817,396	739,535	10.30	191,964	37	36	2,145	.....	.....	.....	24
1,537	1,272	60	522	345	8	1,537	529	60	19,000	7,500	1,842,857	1,295,473	2.42	350,000	160	125	475	167,000	68,327	3.10	25
474	616	40	180	159	3	.....	.....	48	.....	.....	688,988	552,290	9.94	110,183	72	60	963	129,366	42,637	2.48	26
1,462	1,372	.....	233	233	.....	.....	.....	.....	.....	.....	664,369	649,090	9.85	71,041	34	49	1,984	179,040	46,954	3.35	27
181	118	.....	46	34	.....	165	173	.....	4,042	2,753	217,005	167,407	3.25	32,000	12	10	5,562	.....	.....	.....	28
892	736	.....	336	264	.....	.....	.....	.....	.....	.....	625,788	510,708	11.13	53,104	37	30	1,520	212,051	35,538	4.40	29
1,241	1,445	.....	115	83	.....	432	464	.....	7,000	6,400	993,439	776,989	17.98	.....	55	52	1,005	.....	.....	.....	30
.....	.....	.....	43	71	.....	.....	.....	.....	.....	.....	186,858	136,629	3.54	57,457	6	6	8,798	.....	3,060	.....	31
1,194	745	.....	228	183	.....	722	580	.....	.....	.....	788,828	560,299	15.17	.....	75	30	693	.....	.....	.....	32
177	175	89	41	32	5	.....	.....	93	.....	.....	394,064	335,036	7.92	124,850	36	37	1,382	150,415	17,197	3.37	33
332	286	.....	145	50	.....	189	126	.....	7,396	6,932	340,610	291,433	7.93	39,900	[AA]45	[AA]45	955	23,179	10,437	78	34
755	696	.....	169	162	.....	565	288	.....	.....	.....	442,816	374,162	10.55	30,899	28	28	1,499	81,955	24,010	2.52	35
11	6	.....	3	6	.....	.....	.....	.....	.....	.....	32,656	36,812	.81	171,168	9	11	4,530	109,792	8,000	2.89	36
57	57	27	14	9	6	235	103	59	2,816	2,060	277,322	286,964	7.01	53,089	28	28	1,412	[P]25,173	13,682	.98	37
347	302	.....	70	68	.....	473	417	.....	5,668	4,484	303,300	208,624	7.74	63,558	40	30	979	71,963	21,324	2.38	38
1,210	1,194	.....	355	294	.....	464	369	.....	.....	.....	628,769	449,713	16.31	.....	75	70	514	.....	.....	.....	39
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	82,572	78,346	2.34	78,905	6	6	6,090	14,300	4,500	.51	40
362	495	57	85	102	5	454	358	.....	.....	.....	384,900	277,700	10.58	65,000	22	17	1,654	.....	.....	.....	41
233	334	31	33	51	2	299	244	69	3,775	9,089	184,998	[Q]225,636	5.27	46,000	[R]37	[R]37	949	75,000	11,000	2.45	42
544	494	.....	29	38	.....	907	836	.....	2,377	1,891	496,139	391,874	14.38	88,447	20	18	1,725	73,919	13,920	2.55	43
545	394	30	71	59	5	795	455	75	10,529	6,320	246,219	177,956	7.46	25,350	8	5	4,127	29,500	7,179	1.11	44
281	227	.....	82	49	.....	101	81	.....	1,224	937	119,335	79,216	3.70	18,584	11	11	2,929	30,560	6,329	1.14	45
739	660	.....	128	113	.....	545	545	.....	4,449	3,588	379,440	326,515	12.24	40,717	32	29	969	.....	20,873	.....	46
497	263	.....	97	38	.....	483	372	.....	.....	.....	296,434	195,095	10.54	.....	35	.....	803	.....	.....	.....	47
463	457	85	26	26	3	261	263	77	2,548	1,722	273,492	218,880	12.61	.....	.....	.....	.....	.....	16,879	.....	48
20	7	.....	.....	1	.....	.....	1	.....	419	108	46,382	5,526	2.35	.....	3	1	6,589	9,040	2,161	.57	49
222	185	.....	47	62	.....	.....	25	.....	1,186	941	144,516	116,305	8.45	24,943	12	9	1,425	50,587	8,967	3.48	50
.....	.....	78	98	49	7	.....	.....	75	150	100	58,317	36,322	4.32	5,500	3	3	4,497	.....	.....	.....	51
101	164	.....	48	42	.....	.....	.....	.....	300	125	90,277	73,852	7.02	18,317	9	7	1,430	15,500	4,290	1.54	52
32	44	.....	20	13	.....	.....	.....	.....	300	125	43,801	39,297	5.43	10,625	12	12	673	20,000	3,875	2.96	53
65,599	58,197	[V]63	16,582	13,507	[V]51	77,177	39,800	[V]68	700,379	555,346	50,812,298	39,325,648	[Z]6.13	7,204,575	5,122	4,339	[Z]1,613	5,158,943	2,433,727	[Z]2.41	Total
II—SOUTHEAST—South of Ohio River, East of Mississippi River																					
1,413	808	.....	329	144	.....	1,098	1,051	.....	.....	.....	3,113,741	2,905,746	21.70	.....	185	228	776	.....	.....	.....	54
16	27	.....	18	8	.....	441	411	.....	24,027	20,039	1,952,266	1,402,549	14.36	.....	.....	.....	.....	.....	.....	.....	55
1,001	815	.....	180	206	.....	654	757	.....	.....	.....	2,455,772	2,285,721	22.40	.....	175	.....	626	.....	.....	.....	56
1,083	1,014	.....	130	85	.....	174	253	.....	.....	.....	1,728,672	1,576,693	18.01	.....	100	53	960	.....	.....	.....	57
100	87	.....	34	9	.....	74	43	.....	11,482	14,926	364,005	397,459	4.09	107,784	46	42	1,934	.....	.....	.....	58
1,092	[BB]430	65	184	137	3	627	[CC]48	58	6,831	6,000	678,416	526,695	9.30	88,589	23	7	3,171	46,066	31,154	1.06	59
483	575	.....	117	99	.....	.....	.....	.....	.....	.....	549,287	437,596	8.18	63,369	34	31	1,974	32,229	40,762	1.09	60
55	438	.....	[S]...	[S]...	.....	80	379	.....	15,044	15,703	790,542	1,136,141	12.01	264,709	73	71	902	.....	.....	.....	61
48	88	15	.....	.....	.....	184	243	50	20,285	25,756	260,280	274,307	4.64	55,354	63	48	989	174,677	48,027	3.97	62
149	125	3	38	47	.....	187	117	.....	7,156	564	224,899	218,010	6.92	64,661	34	31	956	.....	.....	.....	63
58	57	.....	9	5	.....	29	22	.....	578	527	258,170	306,362	8.37	99,070	20	20	1,542	62,425	17,000	2.58	64
35	39	40	6	5	3	.....	.....	.....	.....	.....	134,656	119,059	4.92	120,516	9	6	3,041	30,000	9,000	1.43	65
200	224	.....	32	76	.....	66	149	.....	.....	.....	499,855	501,099	17.31	.....	[U]60	[U]50	481	.....	.....	.....	66
38	43	.....	5	5	.....	.....	.....	.....	.....	.....	256,510	296,089	11.06	116,708	20	20	1,160	.....	9,000	.....	67
132	131	.....	22	9	.....	169	79	.....	.....	.....	343,706	375,079	18.51	.....	[T]18	.....	1,031	.....	.....	.....	68
8	2	.....	.....	1	.....	19	14	.....	1,776	402	[V]116,967	[V]101,183	7.53	65,000	8	9	1,943	.....	.....	.....	69
8	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	138,572	137,963	9.92	22,717	7	8	1,888	40,589	7,614	3.45	70
138	82	.....	9	3	.....	66	42	.....	1,613	1,857	142,156	143,716	11.12	70,733	8	8	1,598	.....	.....	.....	71
4	9	.....	2	6	.....	.....	.....	.....	618	1,136	58,708	109,028	4.83	[M]72,012	12	12	1,325	36,065	3,453	3.25	72
206	86	.....	23	8	.....	55	56	.....	.....	.....	312,366	191,836	28.62	.....	18	11	606	.....	.....	.....	73
6,267	5,087	[V]31	1,138	853	[V]3	3,923	3,664	[V]54	89,410	86,910	14,379,546	13,442,331	[Z]13.53	1,211,222	913	655	[Z]1,015	422,051	166,010	[Z]2.65	Total

[B] Five full time; 32 part time. [S] Included in all other appliances. [T] Not including local managers. [U] Includes 42 local managers part time. [V] Domestic and commercial. [W] Included in direct cost. [X] Salesmen 75% combination electric and gas. [Y] Straight line average. [Z] Weighted average. [AA] Half time selling gas and electric. [BB] Resumed selling May 1, 1935. [CC] Resumed selling Dec. 15, 1935. [DD] Except floor sales people. [EE] Paid to salesmen. [FF] All other load building expense. [GG] Including advertising expense.

(*Continued*)

Domestic Appliance Sales by Power Companies

Table I— Total sales of household appliances by 11 power companies during the full year 1936, together with estimates of dealer sales of refrigerators, ranges and water heaters in the same areas.

Company	Total Domestic Consumers December 31	Average Annual Domestic Kw.-Hr. Consumption		Average Revenue per Consumer	Av. Costs for Domestic Service—Cents	Refrigerators Units Sold By Power Cos.		Refrigerators Units Sold By Dealers Pwr. Co. Est.		Saturation Refrigerators Percent	Ranges Units Sold By Power Co.		Ranges Units Sold By Dealers Pwr. Co. Est.		Saturation Ranges Percent	Water Heaters Units Sold By Power Cos.		Water Heaters Units Sold By Dealers Pwr. Co. Est.		Saturation Water Heaters Percent
	1936	1936	1935	1936	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																				
74	[H] 315,202	804	685	$36.00	4.49	4,015	4,275	19,275	15,800	34	4,282	4,014	2,733	1,359	9	2,901	3,010	1,190	733	3
75	[H] 256,482	937	870	.....	.....	1,069	655	40,078	39,350	64	1,334	1,085	2,801	1,409	4	.....	.....	.....	.....	.....
76	98,098	875	806	38.92	4.45	1,524	1,444	.....	.....	.....	[C] 1,732	[C] 1,238	.....	.....	.....	[D] 486	[D] 387	.....	.....	.....
77	[H] 82,671	518	489	32.37	6.25	892	690	4,521	2,495	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
78	59,547	850	775	36.57	4.30	456	410	5,950	5,316	55	188	97	80	29	5	148	34	16	.....	1
79	57,562	742	685	35.27	4.75	283	257	6,664	6,572	55	251	232	149	93	3	127	3	30	2	.....
80	52,114	695	617	39.30	5.70	1,442	1,584	5,598	4,868	42	664	602	34	24	4	214	172	1	3	1
81	49,530	648	596	39.68	5.97	1,430	908	7,383	4,946	.....	226	102	57	16	.....	51	24	6	.....	.....
82	[H] 48,279	669	604	37.04	5.54	1,329	1,000	1,800	1,200	45	123	52	30	20	5	32	6	7	5	.....
83	41,442	868	764	43.98	5.06	2,009	1,898	3,840	4,077	51	1,545	1,201	23	20	12	620	386	.....	.....	3
84	[H] 38,997	655	582	34.09	5.20	984	774	1,667	1,643	18	[C] 163	[C] 62	28	25	6	[D] 245	[D]	4	.....	5
85	[H] 33,360	852	786	42.65	5.00	1,778	3,375	1,397	1,310	.....	397	359	21	20	.....	385	423	6	.....	.....
86	27,444	513	455	30.92	6.00	1,075	929	.....	.....	.....	[C] 185	[C] 152	.....	.....	.....	.....	.....	.....	.....	.....
87	25,662	750	680	32.25	4.30	705	484	600	500	27	[C] 1,016	[C] 1,071	100	50	21	[D] 371	[D] 274	10	10	4
88	[H] 23,401	644	571	34.39	5.34	671	131	2,202	1,465	41	474	339	57	30	6	93	42	8	4	1
89	[H] 23,202	699	610	36.07	5.47	516	489	1,665	1,578	36	572	425	61	54	10	222	161	6	6	2
90	19,344	746	704	38.03	5.10	1,115	781	.....	.....	.....	179	189	.....	.....	.....	18	24	.....	.....	.....
91	19,151	881	809	37.65	3.87	634	.....	833	.....	40	[C] 569	[C]	13	.....	19	[D] 521	[D]	12	.....	12
92	16,830	545	495	33.54	6.18	180	169	1,073	950	33	165	109	23	41	12	27	16	1	2	4
93	[H] 11,925	768	685	36.05	5.00	269	682	1,448	1,168	53	106	121	.....	.....	5	47	67	.....	.....	2
94	9,112	634	553	36.51	5.76	119	14	901	977	42	224	124	46	55	11	140	48	15	.....	5
95	[H] 8,713	626	561	33.04	5.20	350	295	588	664	.....	119	93	2	2	.....	25	29	.....	1	.....
96	[H] 5,984	579	530	33.24	5.70	143	42	150	90	30	4	6	.....	.....	1	2	.....	.....	.....	.....
97	5,300	659	564	.....	.....	80	58	330	375	33	195	119	54	41	9	80	33	1	3	2
98	[H] 3,465	828	729	39.53	4.77	37	8	200	220	40	123	99	.....	.....	15	23	15	.....	.....	2
Total	1,332,817	[Y]719	[Y]648	[Y]36.39	[Y]5.19	23,105	21,352	108,163	95,564	[Y] 41	14,836	11,891	6,312	3,288	[Y] 7	6,778	5,154	1,313	769	[Y] 3
IV—WESTERN—West of Rocky Mountains																				
99	[H] 559,282	781	731	30.67	3.85	.....	.....	47,128	37,616	.....	1,829	1,643	2,404	1,570	7	1,578	1,853	997	586	4
100	[H] 150,414	1,121	1,036	31.94	2.85	1,462	966	8,430	7,351	22	4,653	3,432	1,024	750	24	2,161	1,676	462	561	10
101	[H] 103,156	570	534	32.76	5.70	2,230	1,584	.....	.....	.....	584	358	.....	.....	.....	36	15	.....	.....	.....
102	99,650	1,160	1,046	33.55	2.89	867	832	11,630	8,000	30	1,810	1,434	3,400	3,200	24	1,492	1,034	100	.....	5
103	96,896	834	790	36.13	4.33	1,919	1,712	9,170	5,833	47	2,348	1,562	1,205	415	30	912	438	68	8	3
104	[H] 80,107	1,100	1,020	39.56	3.60	676	839	9,621	6,968	62	.....	.....	1,803	1,481	15	.....	.....	951	738	8
105	[H] 67,927	733	645	30.90	4.22	333	290	8,452	6,635	47	515	253	205	128	5	564	415	135	135	3
106	[H] 64,717	781	724	34.73	4.40	1,623	1,553	6,100	.....	.....	1,027	545	85	.....	20	40	22	.....	.....	.....
107	61,564	1,775	1,674	40.15	2.20	412	550	7,018	5,304	30	1,424	969	765	464	30	1,276	1,178	176	126	21
108	48,773	1,382	1,287	38.90	2.81	736	537	5,271	3,715	30	1,101	838	490	485	20	856	721	175	187	14
109	43,470	1,410	1,276	48.53	3.20	721	556	4,472	4,284	35	2,162	1,100	1,418	834	47	2,223	1,206	222	.....	17
110	21,418	682	623	36.18	5.00	500	400	800	600	22	[C] 400	[C] 300	8	10	19	200	75	.....	.....	4
Total	1,398,578	[Y]1,027	[Y]949	[Y]36.17	[Y]3.75	11,479	9,819	118,092	86,306	[Y] 36	17,853	12,434	12,807	9,337	[Y] 22	11,338	8,633	3,286	2,341	[Y] 9
Grand Total	12,077,674	[Y]757	[Y]685	[Y]35.73	[Y]4.90	194,325	163,613	609,536	496,577	[Y] 40	128,641	110,434	52,326	31,360	[Y] 11	51,900	39,468	11,797	7,599	[Y] 4

[A] In non-gas territory only. [B] Rate reductions in 1936. [C] Rent ranges. [D] Rent water heaters. [E] Rent small refrigerators. [F] Includes E. A. R. on refrigerators sold by dealers. [G] Rural only. [H] Operate some gas service also. [I] Budget figures. [J] No longer selling. [K] Outside salesmen only. [L] Salesmen sold both gas and electric for eight months. [M] Includes company and dealers. [N] After April 1. [O] Includes all advertising. [P] Excludes appliance servicing. [Q] Includes dealer sales financed by com-

Table II–Regional Summary and Comparison of

Some general reflections of local conditions and the sales activity of the power companies in the four major areas of the country.

Region	Total Domestic Consumers Dec. 31, 1936	Av. Dom. Kw.-Hr. Consumption 1936	Kw.-Hr. Increase Over Dec. 31, 1935	Av. Cost of Dom. Service Cents 1936	Av. Revenue per Consumer 1936	Refrigerator Units Sold by Power Cos. 1936	Ranges Units Sold by Power Cos. 1936	Water Heaters Units Sold by Power Cos. 1936	Clothes Washers Units Sold by Power Cos. 1936	Ironing Machines Units Sold by Power Cos. 1936	Vacuum Cleaners Units Sold by Power Cos. 1936	Refrigerators Sold per 1,000 Consumers 1936	Ranges Sold per 1,000 Consumers 1936	Water Heaters Sold per 1,000 Consumers 1936	Clothes Washers Sold per 1,000 Consumers 1936
Northeast	8,283,565	677	58	5.13	$34.15	117,871	70,161	20,041	65,599	16,582	51,177	14	9	2	8
Southeast	1,062,714	854	104	4.64	38.82	41,870	25,791	13,743	6,267	1,138	3,923	39	24	13	5
Central	1,332,817	719	71	5.19	36.39	23,105	14,836	6,778	7,224	1,334	6,280	17	11	5	5
Western	1,398,578	1,027	78	3.75	36.17	11,479	17,853	11,338	4,390	1,491	3,496	8	13	8	3
Nat'l Total or Average	12,077,674	757	72	4.90	35.73	194,325	128,641	51,900	83,480	20,545	64,876	16	10	4	7

and Local Dealers for the Full Year 1936

Also, comparisons of these sales totals with the year 1935, with data on average consumption, rates, revenues, saturations, sales totals, sales people and direct sales and promotional expense in building domestic load — embracing over twelve million consumers.

Clothes Washers Units Sold By Power Cos.		Saturation Clothes Washers Percent	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines Percent	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners Percent	All other Appliances Units Sold By Power Cos.		Total Sales of All Appliances By Power Cos.		Power Co. Appl. Sales Per Consumer	Annual Revenue Increase from Power Co. Sales	Number Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Direct Sales Expense	Power Co. Advertising & Promotion Exp.	Sales & Adv. Expense Per Consumer	Company
1936	1935	1936	1936	1935	1936	1936	1935	1936	1936	1935	1936	1935	1936	1936	1936	1935	1936	1936	1936	1936	
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																					
782	844	70	218	242	11	1,754	1,400	70	23,193	19,551	$1,745,558	$1,632,115	5.54	$315,870	199	181	1,584	$495,000	$210,000	2.24	74
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	116	130	2,211	.....	169,600	.....	75
526	757	.....	211	777	.....	433	251	.....	45,591	47,234	879,992	684,453	8.88	183,886	85	85	1,154	160,000	135,000	3.01	76
547	580	.....	22	35	.....	361	358	.....	28,760	27,627	406,025	323,071	4.91	247,821	56	56	1,476	173,570	82,307	3.10	77
291	348	.....	73	87	.....	844	945	.....	.....	.....	307,685	289,325	5.17	.....	.....	.....	.....	.....	.....	.....	78
192	144	50	.....	57	6	43	37	70	.....	.....	167,155	146,313	2.90	335,787	85	80	677	106,233	31,597	2.39	79
822	545	.....	155	56	.....	256	197	.....	.....	.....	495,996	456,371	9.52	64,054	26	32	2,004	35,542	14,823	9.66	80
289	242	.....	.....	.....	.....	132	367	.....	10,544	5,791	541,685	405,885	10.94	.....	30	29	1,651	.....	37,437	.....	81
1,163	768	62	141	114	.....	810	764	60	2,788	1,936	491,572	371,560	10.18	.....	50	35	966	65,000	56,000	2.51	82
167	121	.....	6	4	.....	138	124	.....	14,971	10,571	643,633	528,750	15.53	104,680	DD68	DD54	609	135,000	27,064	3.91	83
243	169	.....	46	51	.....	361	189	.....	6,148	5,583	393,000	244,000	10.08	88,073	40	28	975	.....	25,000	.....	84
757	947	.....	99	66	.....	272	187	.....	.....	.....	760,201	938,187	22.79	168,878	55	55	607	.....	.....	.....	85
359	220	.....	40	10	.....	194	161	.....	2,619	1,702	367,919	311,896	13.41	88,725	24	22	1,144	55,194	13,887	2.52	86
87	105	.....	35	12	.....	36	26	.....	1,200	1,000	313,135	249,357	12.20	70,000	11	10	2,333	EE37,758	FF54,742	3.60	87
241	249	.....	75	106	.....	65	.....	.....	724	.....	248,586	112,441	10.62	103,478	36	13	650	.....	.....	.....	88
165	255	.....	66	54	.....	236	.....	.....	2,596	.....	.....	.....	.....	102,089	25	18	928	58,721	18,975	3.35	89
158	219	.....	22	25	.....	247	206	.....	2,492	1,702	355,724	242,214	18.39	65,000	21	21	921	50,773	37,795	4.58	90
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	116,654	105,777	6.09	.....	12	12	1,596	60,684	27,321	4.60	91
230	147	60	70	41	5	.....	.....	.....	.....	.....	104,372	75,488	6.20	29,494	18	15	935	GG26,354	7,424	2.01	92
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	186,910	184,269	15.67	60,000	15	15	795	.....	9,852	.....	93
50	38	.....	20	20	.....	.....	.....	.....	.....	835	84,253	43,617	9.25	17,900	8	6	1,139	26,058	4,290	3.33	94
82	74	.....	33	39	.....	.....	.....	.....	.....	.....	175,839	163,732	20.19	11,942	19	16	456	.....	.....	.....	95
73	89	70	2	2	5	98	109	70	920	772	61,864	41,973	10.34	17,054	6	7	997	14,593	12,404	4.51	96
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50,400	33,100	9.51	.....	3	2	1,766	.....	.....	.....	97
.....	.....	.....	.....	.....	.....	.....	.....	.....	679	784	33,519	27,945	9.67	6,600	3	3	1,155	8,417	W	2.43	98
7,224	6,861	Y 62	1,334	1,798	Y 7	6,280	5,321	Y 68	143,225	125,088	8,931,677	7,611,839	Z 8.48	2,081,331	1,011	925	Z 1,259	1,508,897	975,518	Z 2.65	Total
IV—WESTERN—West of Rocky Mountains																					
.....	.....	47	.....	.....	7	.....	.....	57	.....	.....	618,534	565,487	1.11	M 1,676,088	X 200	X 200	2,796	245,000	203,000	.80	99
826	974	.....	276	251	.....	1,140	1,170	.....	2,420	1,245	1,088,847	838,627	7.24	325,423	138	134	1,090	461,000	74,000	3.56	100
283	434	43	110	119	5	171	163	54	10,942	10,118	956,433	706,640	9.27	.....	80	70	1,289	.....	86,600	.....	101
482	495	50	159	110	5	450	863	50	5,816	6,013	673,835	599,376	6.76	130,000	60	55	1,661	177,147	87,553	2.66	102
.....	.....	.....	.....	.....	.....	.....	.....	.....	13,577	8,755	938,751	815,847	9.69	164,342	115	49	743	318,524	126,641	4.59	103
167	330	77	73	85	5	117	157	80	6,042	8,288	225,860	296,980	2.82	180,925	38	38	2,108	.....	.....	.....	104
324	289	.....	110	145	.....	276	211	.....	8,992	4,957	310,705	241,495	4.57	136,600	.....	.....	.....	105,256	44,415	2.20	105
239	439	.....	.....	95	.....	517	480	.....	9,132	13,743	616,687	546,855	9.53	213,675	38	40	1,703	.....	.....	.....	106
373	531	65	130	.....	15	302	594	80	6,541	10,678	455,023	431,402	7.39	75,733	42	38	1,466	154,250	133,640	4.68	107
1,040	842	70	370	334	8	168	179	30	.....	.....	561,601	493,657	11.51	103,476	44	40	1,108	.....	.....	.....	108
526	577	75	213	147	10	155	281	65	5,400	3,915	661,219	490,617	15.21	144,070	67	67	649	149,738	29,571	4.12	109
130	130	40	50	40	4	200	175	50	5,000	4,000	200,183	168,949	9.35	52,000	14	14	1,530	38,898	4,500	2.03	110
4,390	5,041	Y 58	1,491	1,326	Y 7	3,496	4,273	Y 58	73,862	71,712	7,307,678	6,195,932	Z 5.23	3,202,332	836	745	Z 1,592	1,649,813	789,920	Z 2.14	Total
81,480	75,186	Y 58	20,545	17,484	Y 6	64,876	53,058	Y 64	1,006,876	839,056	81,431,199	66,575,750	Z 6.90	13,699,460	7,882	6,664	Z 1,494	8,739,704	4,365,175	Z 2.47	Grand Total

pany. A Five full time; 32 part time. B Included in all other appliances. C Not including local managers. D Includes 42 local managers part time. E Domestic and commercial. F Included in direct cost. G Saleamen 75% combination electric and gas. H Straight line average. I Weighted average. AA Half time selling gas and electric. BB Resumed selling May 1, 1935. CC Resumed selling Dec. 15, 1935. DD Except floor sales people. EE Paid to salesmen. FF All other load building expense. GG Including advertising expense.

Sales Totals, Saturations and Averages

Relating roughly the prevailing cost of using appliances, their present popularity and the scale on which they are being sold

Ironing Machines Sold per 1,000 Consumers 1936	Vacuum Cleaners Sold per 1,000 Consumers 1936	Average Saturation Refrigerators 1936 %	Average Saturation Ranges 1936 %	Average Saturation Water Heaters 1936 %	Average Saturation Clothes Washers 1936 %	Average Saturation Ironing Machines 1936 %	Average Saturation Vacuum Cleaners 1936 %	Total Appliance Sales 1936	Appliance Sales per Consumer 1936	Total Annual Revenue Increase 1936	Total Sales People on Domestic Load 1936	Consumers per Sales Person 1936	Power Co. Direct Sales Expense 1936	Power Co. Adv. & Promotion Expense 1936	Sales & Adv. Exp. per Consumer 1936	Region
2	6	36	8	2	63	5	68	$50,812,298	$6.13	$7,204,575	5,122	1,613	$5,158,943	$2,433,727	$2.14	Northeast
1	3	47	13	6	31	3	54	14,379,546	13.53	1,211,222	913	1,015	422,051	166,010	2.65	Southeast
1	5	41	7	3	62	7	68	8,931,677	8.48	2,081,331	1,011	1,259	1,508,897	975,518	2.65	Central
1	3	36	22	9	58	7	58	7,307,678	5.23	3,202,332	836	1,592	1,649,813	789,920	2.44	Western
2	5	40	11	4	58	6	64	81,431,199	6.90	13,699,460	7,882	1,494	8,739,704	4,365,175	2.47	Nat'l Total or Average

specific devices these companies themselves put on their lines 19 per cent more refrigerators, 16% more ranges, 31 per cent more water heaters, 11 per cent more clothes washers, 18 per cent more ironing machines and 22 per cent more vacuum cleaners than the year before. This also shows some interesting comparisons with the gains in 1935 over 1934, when the percentages for 103 companies were refrigerators 24, ranges 75 and water heaters 84. These figures were published in ELECTRICAL WORLD survey on March 14, 1936.

New figures are available this year, too, on the sale of I.E.S. lamps by 87 of the companies who merchandise. They sold 406,805 of these lamps in 1936, as against 200,250 in 1935. I.E.S. lamps are reported this year for the first time in this survey and are not tabulated for want of space. Details of sales by companies will be provided, however, on request.

Load Building—1936

By 110 Power Companies Serving 12,077,674 Domestic Consumers

	Per Cent
Increased merchandise sales	22
Increased average annual consumption	11
Increased sales personnel	18

They sold:
- 9 per cent more refrigerators
- 13 per cent more ranges
- 26 per cent more water heaters
- 11 per cent more clothes washers
- 18 per cent more ironing machines
- 22 per cent more vacuum cleaners

Southeastern power companies report:
- —largest gains in average consumption
- —largest appliance sales per consumer
- —largest revenue per consumer
- —lowest number of consumers per sales person
- —largest sales of refrigerators, ranges and water heaters per 1,000 consumers

Central area power companies report:
- —highest refrigeration saturation

Pacific Coast power companies report:
- —highest average annual domestic consumption*
- —lowest average domestic rate
- —highest range saturation
- —highest water heater saturation

* Highest average for any complete operating system.

Dealer sales are still pretty indefinite, in that so many companies lack information. Of 110 companies which sell appliances, local dealer sales were estimated on refrigerators by 91, on ranges by 84, on water heaters by 64, on clothes washers by 56, on ironing machines by 53, on vacuum cleaners by 39, on I.E.S. lamps by 40 and on all other appliances by 30. But apparently something is being done about it. This time eight more companies reported on dealer sales of refrigerators, ten more on ranges, fourteen more on water heaters. It looks as though those who have disregarded it in the past are beginning to realize that a record of dealer sales of the major appliances is vital to any accurate knowledge of domestic load growth.

And as a matter of fact, dealer sales are steadily gaining in importance. For those companies reporting, dealer sales of refrigerators in 1936 increased by 81,173 or 15 per cent, sales of ranges jumped by 20,066 or 67 per cent, sales of water heaters grew by 4,196 or 56 per cent, and ironing machines increased by 4,020 or 12 per cent. Clothes washers and cleaner sales also increased by 18 and 25 per cent, respectively. So although the power companies showed a larger percentage of increase than the dealers in refrigerators sold, the dealers are making remarkable strides as outlets for ranges and water heaters. They are steadily becoming more of a factor as creators of this desirable load.

Dealers' sales of I.E.S. lamps were reported as 158,269 in 1935 and 280,294 in 1936, an increase of 77 per cent.

Last year, in the territory covered by the systems reporting both power company and dealer sales, these power companies sold 17 per cent of the refrigerators, 62 per cent of the ranges, 79 per cent of the water heaters, 18 per cent of the clothes washers, 24 per cent of the ironing machines, 13 per cent of the vacuum cleaners and 35 per cent of the I.E.S. lamps. Therefore, the dealers sold refrigerators 83 per cent, ranges 38 per cent, water heaters 21 per cent, clothes washers 82 per cent, ironing machines 76 per cent, cleaners 87 per cent and I.E.S. lamps 65 per cent. This shows a distinct advance compared with the proportion sold by dealers in 1935, which were refrigerators 76 per cent, ranges 25 per cent, water heaters 16 per cent, clothes washers 88 per cent, ironing machines 72 per cent and cleaners 86 per cent.

In all, 81 companies this time estimate the annual revenue gained from appliance sales. The total E.A.R. reported by 75 companies which gave a comparison of both years aggregated $12,511,102 for 1936, as against $10,520,454 for the full year previous, an increase of 19 per cent.

As already noted, a Pacific Coast company holds the lead for average annual domestic consumption. The next in size in that section are 1,410 and 1,382 kw.-hr. The Southeastern district reports its best company average as 1,183, with the next 1,176. The highest reported for the Central section is 937 and from the Northeast 866. Five Southeastern companies made larger gains in average consumption than any other utility reporting. There were increases of 209, 180, 163, 156 and 152 kw.-hr., while the largest gain on the Pacific Coast was 134, and in the Northeast 123 and in the Central area 104—an outstanding accomplishment, proof of what highly organized promotion can do.

The highest reported average appliance sales per consumer last year was $28.62 by a Southeastern company. The next in point of size in the Southeast were $22.40 and $21.70. The top in the Northeast was $17.98, in the Central area $22.79 and in the far West $15.21. The lows go down to $4.09 in the Southeast, $0.81 in the Northeast, $2.90 in the Midwest and $2.82 on the Coast. The national average for this survey is $6.90, with these regional averages—Northeast $6.13, Southeast $13.53, Central $8.48 and on the Pacific Coast $5.23.

The average cost of service to the domestic consumer ranged from 3.46 to 7.39 cents per kilowatt-hour in the Northeast, from 3.13 to 6.30 in the Southeast, from 3.87 to 6.25 in the mid-continent area and from 2.20 to 5.70 cents on the Coast. Meanwhile, average revenue per domestic consumer showed tops of $56.45 in the Southeast, $46.02 in the Northeast, $43.98 in the Central area and $18.90

on the Pacific Coast. In the Northeast 42 companies reported gains and eleven losses in average revenue per consumer, in the Southeast sixteen had gains and four losses, in the Central section eighteen showed increases and five decreases and on the coast eleven had gains against one with a loss. The losses are presumably all caused by rate reductions, made during the year, from which increased consumption had not yet had time to catch up.

To do this record-smashing job of load building the companies have been increasing their sales personnel. Those reporting employed 7,882 salespeople, compared with 6,664 in 1935, a boost of 18 per cent. There are some notable examples of rapid expansion. One company jumped from 425 to 531, another from 46 to 133, another from 294 to 363, another from 49 to 115, another from 53 to 100. But there is still a wide difference in the number of domestic consumers that a salesman is supposed to cover.

The most intensive coverage reported is 456 consumers per sales person by a southeastern company. From this it runs up to 6,665, 8,022 and, the worst, one company that expects one man to call on 8,798, which cannot be done. And the utilities are finding this out. A year and a half ago one company stood out conspicuously in this survey with 12,708 consumers per salesman. Something has been done about it.

All this selling is also reflected in the saturation figures, and here again the industry is marching ahead. The average saturation for the companies reporting for 1936 was refrigerators 40 per cent, ranges 11 per cent, water heaters 4 per cent, clothes washers 58 per cent, ironing machines 6 per cent, vacuum cleaners 64 per cent and I.E.S. lamps 26 per cent.

The highest individual saturation estimates for the various appliances were for refrigerators 64 per cent in the Central area, with leading companies in the Southeast and Pacific Coast pressing it close with 63 and 62 per cent respectively. The highest saturation reported for ranges was 47 on the Coast, for water heaters 21 per cent on the Coast, for clothes washers 89 per cent in the Northeast, for ironing machines 16 per cent in the Northeast and for cleaners 93 per cent in the Northeast. All this compares with the following national saturation percentages reported for 1936 by the several manufacturers' associations: refrigerators, 41; ranges, 8; clothes, washers, 52; ironing machines, 6, and vacuum cleaners, 49.

There is still a blind spot in many cities, however, as to what saturation of these major appliances has been built up so far. Out of the 110 companies that are actively merchandising, only 80 knew their saturation on refrigerators, 77 on ranges, 61 on water heaters, 34 on clothes washers, 32 on ironing machines, 30 on cleaners and 24 on I.E.S. lamps. Yet here lies the measure of the market!

As in former surveys, the comparison of the saturations, consumption averages and annual domestic revenue reported by those companies that actively sell load-building appliances and those that do not is a matter of keen interest and again provides material for speculation.

This non-merchandising group shows a total gain of 8 per cent over last year in average annual consumption against 11 per cent for the companies

Table IV
Who Sells the Appliances

Proportion of the major appliances sold by power companies and local dealers, as estimated, in units, by the reporting companies.

Appliances	Power Company Sales Per Cent	Dealer Sales Per Cent
Refrigerators	17	83
Ranges	62	38
Water heaters	79	21
Clothes washers	18	82
Ironing machines	24	76
Vacuum cleaners	13	87

Table III—Load Building Where the Power Company Sells No Appliances

Consumption, growth of load, average rates, revenue and number of salespeople and advertising and promotion expense per consumer, together with power company estimates of dealer sales and saturations of the major appliances

Company	Total Domestic Consumers		Av. Annual Domestic Consumption		Av. Annual Dom. Revenue	Av. Cost for Dom. Service —Cents	Refrigerators Units Sold By Dealers	Saturation of Refrigerators	Ranges Sold By Dealers	Saturation of Ranges	Water Heaters Sold By Dealers	Saturation of Water Heaters	Number Power Company Salesmen and Women Building Dom. Load		Advertising and Promotion Expense		Adv. and Prom. Exp. per Consumer
	1936	1935	1936	1935	1936	1936	1936	1936	1936	1936	1936	1936	1936	1935	1936	1935	1936
1	649,519	638,875	525	493	$30.21	5.75	47,000	35	[C] 5,400	.....	3	.....	107	69	.....	.....	.....
2	397,900	383,500	807	737	32.75	4.06	51,409	50	6,575	8	3,002	3	160	140	$180,000	$170,000	$0.45
3	306,324	300,092	606	562	33.72	5.56	10,915	.....	4,334	.....	3	.....	31	21	.....	.....	.....
4	[G]157,433	155,438	936	883	29.92	3.20	11,370	.....	782	7	1	.....	54	53	.....	.....	.....
5	152,771	146,009	1,068	1,008	34.44	3.22	20,045	.....	2,697	.....	126	.....	21	19	.....	.....	.....
6	[E]116,875	111,494	714	602	42.77	.....	[A] 2,347	.....	[A] 85	.....	[A] 3	.....	4	4	.....	.....	.....
7	102,551	94,278	705	648	39.43	5.80	13,443	50	89	2	.....	.....	15	11	50,000	40,000	0.49
8	74,708	73,426	731	682	36.60	5.00	5,845	40	1,398	11	.....	.....	47	31	33,000	25,813	0.44
9	60,770	58,972	1,090	973	40.40	3.71	6,916	50	[C] 1,576	16	317	3	31	27	60,000	48,000	0.99
10	[E] 59,460	56,520	814	760	41.87	5.14	3,670	.....	1,272	.....	179	.....	28	28	.....	.....	.....
11	[E] 54,600	51,661	566	526	26.49	4.68	6,138	38	100	1	27	1	22	22	.....	.....	.....
12	[E] 54,145	50,230	735	680	38.85	5.29	6,009	44	249	.....	21	1	12	10	34,000	30,000	0.63
13	[G] 52,906	49,087	820	741	36.21	4.42	2,046	.....	1,086	16	[D] 47	.....	[B] 64	62	.....	.....	.....
14	39,397	38,350	616	566	35.59	6.60	5,200	.....	560	.....	60	.....	.....	.....	.....	.....	.....
15	33,882	32,577	1,240	1,177	33.50	2.70	3,732	.....	1,590	33	294	.....	18	20	139,329	.....	4.11
16	[E] 27,463	26,705	672	619	38.20	4.50	2,486	34	[C]	.....	.....	.....	11	5	15,089	14,000	0.55
17	[E] 21,330	20,206	830	756	23.53	5.30	2,909	.....	167	.....	43	.....	30	25	.....	.....	.....
18	[G] 19,680	19,148	1,970	1,842	40.54	2.06	1,987	.....	1,582	37	.....	.....	11	14	.....	.....	.....
19	[E] 18,318	17,762	672	585	31.00	4.68	2,522	40	[C]	.....	[D]	.....	3	3	10,000	10,000	0.55
20	[E] 11,113	10,113	812	769	45.99	5.65	1,283	70	109	20	47	10	4	3	10,246	8,687	0.92
21	[E] 9,433	8,908	1,181	1,028	45.70	3.92	1,099	54	817	49	189	12	2	2	5,800	4,000	0.61
22	[G] 9,306	9,035	1,053	949	31.44	2.99	480	.....	203	21	[D] 1	.....	8	6	.....	.....	.....
23	9,000	8,300	576	648	36.00	5.00	1,500	50	.....	1	.....	.....	1	1	4,200	.....	0.47
Total.	2,438,884	2,360,686	[F] 858	[F] 793	[F] 35.88	4.51	257,151	[F] 46	30,671	[F] 17	4,363	[F] 5	684	576	$541,664	$350,500	[F] $0.93

[A] Eight months sales. [B] Of these 43 men work 40 per cent on domestic sales. [C] Rent ranges. [D] Rent water heaters. [E] Operate some gas service also.
[F] Straight line average. [G] Local subsidiaries of one operating company.

that actively sold domestic appliances.

The 23 non-merchandising companies serving 2,438,884 consumers, a gain of 3 per cent over 1935, report an average saturation of refrigerators of 46 per cent, with twelve companies reporting, against an average saturation of 40 per cent for the merchandising companies. On ranges thirteen non-merchandising companies report a saturation of 17 per cent, against 11 per cent for the utilities that sell them. On water heaters six non-merchandising companies report an average saturation of 5 per cent, against 4 per cent shown by the companies that themselves sell appliances.

Average revenue per consumer among the non-merchandising companies has also risen. The highs are $45.99 in the Southwest, and $45.70 on the Coast. This compares with the high of $56.45 by the companies that sell appliances. As to average cost of service to the consumer, the lows for non-merchandising companies are 2.06 cents in the East and 2.7 in the far West. Highs are 6.6 cents in the East and 5.8 cents in the Central area. The total personnel employed in load building through dealer sales for these 23 companies jumped from 576 to 680, a gain of 19 per cent. Their expenditure for promotion rose from $350,500 to $398,135, or 13 per cent, and the average expenditure was 93 cents per domestic consumer.

Of the twenty-three reporting companies, all could report dealer sales of refrigerators, twenty of ranges, seventeen of water heaters, twelve of clothes washers, eleven of ironing machines, ten of cleaners and twelve of I.E.S. lamps. They were largely without data as to saturations. Of the 23 companies twelve knew the saturation of refrigerators, thirteen of ranges, six of water heaters, five of clothes washers, five of ironers and four of cleaners and I.E.S. lamps.

The rental of ranges continues and nineteen companies put out 11,384, against twenty companies that rented 10,524 in 1935. Also, seventeen companies that rented 3,750 water heaters in 1935 put out 6,834 on that basis last year. Rentals of small refrigerators fall away from four companies, that put out 1,855 in 1935 to one company that put out 39 last year.

This survey presents interesting cost figures not heretofore attempted. Because of the lack of uniformity in merchandising accounting methods among the power companies, no sales executive has ever been able to make a general comparison of his costs with those of a large number of other companies. Therefore, a year ago it was suggested that we make a start in listing separately the total expenditure of each company for direct sales and for advertising promotion for domestic business only. This was laid before the sales managers who have been regularly reporting their sales. So large a number agreed to keep cost data for us, on a comparable basis, that these two features have now been added to the tabulation. The specifications were laid down as follows:

Direct Sales Expense—Include salaries and expenses of all sales personnel concerned with building domestic load—salesmen, lighting specialists, home demonstrators, appliance service men, dealer contact men—who devoted their time to selling appliances, lamps and lighting and keeping this equipment in use.

Advertising and Promotion Expense—Include advertising, exhibits, demonstrations and other activities to promote the sale of home appliances or light or to increase the use of domestic service, by the power company or through dealer outlets.

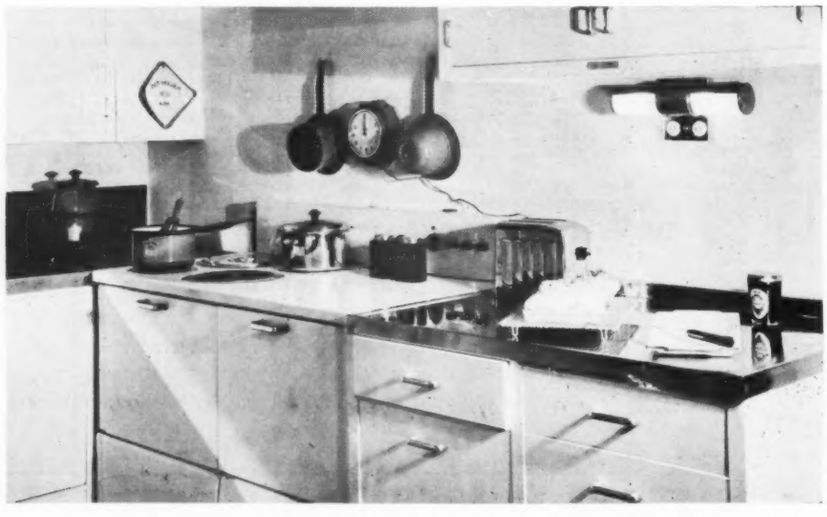
No attempt has been made to embrace any elements of overhead expense, such as executive salaries or rental. On this basis it is gratifying to note that 57 companies have reported costs, divided into these two classifications. The total expenditures reported for direct sales cost was $8,739,704, against $4,365,175 for advertising and promotion. These companies spent on the average for load building $2.47 per consumer.

The highest expenditures for domestic consumers were $9.66 in the Central area, $4.68 on the Pacific Coast, $3.97 in the Southeast and $3.48 in the Northeast. The lows were $2.01 in the Central area, $1.06 in the Southeast, $0.80 on the Coast and $0.51 in the Northeast. No comparison is offered in the tabulation between the cost of selling in 1936 and 1935, but it is expected that next year will provide a valuable reflection of what the various utilities are spending to build domestic load and what they are gaining by it.

Table V
Trends in Renting Appliances

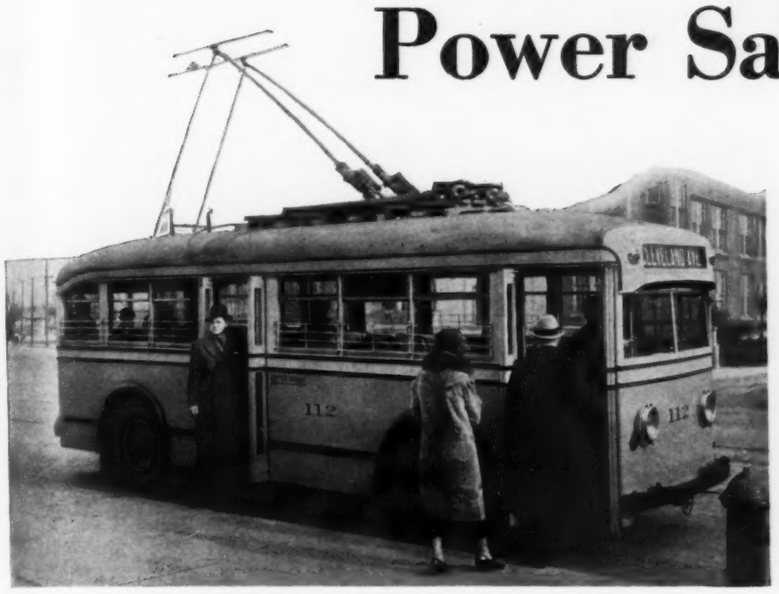
Number of reporting companies which were renting ranges, water heaters and small refrigerators during the first half of this year and last.

Company	Ranges Rented		Water Heaters Rented		Refrigerators Rented	
	1936	1935	1936	1935	1936	1935
4	4,191	3,553	4,222	1,721	....	.....
12	620	495	.....	.....	....	.....
13	541	370	111	47	....	.....
14	.....	.....	449	.....	....	.....
18	.....	.....	79	58	....	.....
25	21	.....	.....	.....	....	.....
38	320	235	217	143	....	.....
41	.....	.....	.....	.....	....	461
42	606	683	77	45	....	169
54	.....	29	.....	31	....	1,196
56	40	122	75	96	....	.....
64	101	182	23	73	....	.....
69	97	105	52	37	39	29
73	.....	1	3	3	....	.....
77	1,269	921	478	383	....	.....
84	223	455	255	591	....	.....
86	142	23	.....	.....	....	.....
87	639	475	322	229	....	.....
91	255	286	296	219	....	.....
94	.....	121	.....	67	....	.....
110	20	25	.....	.....	....	.....
Rentals by companies that sell no appliances						
1	429	.....	.....	.....	....	.....
9	1,786	2,366	.....	.....	....	.....
13	.....	.....	166	1	....	.....
16	82	77	.....	.....	....	.....
18	.....	.....	.....	6	....	.....
19	2	10	3	.....	....	.....
22	.....	.....	6	.....	....	.....
Total	11,384	10,534	6,834	3,750	39	1,855



As in the home, domestic load building centers around the kitchen and the art of good cooking

Trolley Coaches Increase Power Sales



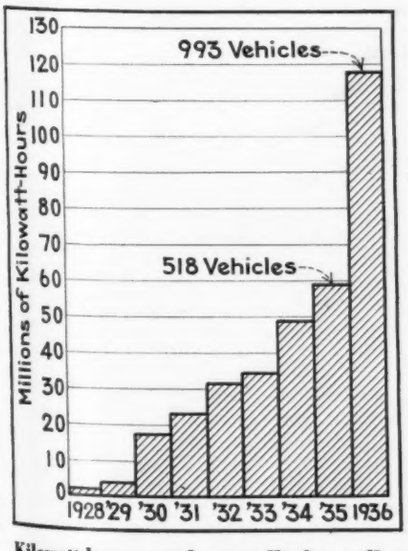
Columbus uses thirty-eight trolley coaches

Striking Growth Taking Place in Vehicles Which Rescue the Disappearing Trolley Load—Create New Avenue for Power Sales

By W. J. CLARDY
Transport Division,
Westinghouse Electric & Manufacturing Company

MORE and more the attention of public utility companies is being attracted to the possibilities of the trolley coach as a load builder in the transit field. Beginning with eleven units for Salt Lake City during 1928, the total number in the United States has practically reached the 1,000 mark. In 1936 475 trolley coaches were placed in service or purchased prior to October 1, thus almost doubling the number of these vehicles in use.

A single-motor 30-passenger trolley coach will use 84,000 kw.-hr. annually at the substation direct-current, bus based on the operation of 40,000 vehicle-miles. Corresponding requirements for the two-motor and single-motor 40-passenger vehicles are 120,000 and 130,000 kw.-hr., respectively. Vehicles purchased this year will take the annual power consumption above the 118,000,000 kw.-hr. mark. The "power used" chart indicates the rapid growth of this market for electric current. It is felt that one-third of surface urban transit vehicles with electric propulsion should be trolley coaches. A conservative estimate is 12,000 to 15,000 units, which on this basis would mean an annual load of 1,400,000,000 to 1,750,000,000 kw.-hr. And this is a load which should not be allowed to "slip through the fingers" of the public utility industry.



Kilowatt-hours used annually by trolley coaches at d.c. substation bus

Trolley coaches have proved popular with both the passenger and the transit operator. Rider approval of this smooth, rapid-starting, quiet-operating vehicle is reflected by increases in gross revenue. Fast schedules, clean electric heat, adequate lighting and the absence of an obnoxious, rattling exhaust contribute substantially to passenger comfort. Transit operators find that the trolley coach provides the lowest cost, as well as the best "ride on rubber." Thus, increases in gross revenue combine with reductions in expenses to make the net revenue an annually attractive figure.

There are 33 cities, ranging in population from 29,000 to 7,000,000, which operate 993 trolley coaches. Eight of these cities initiated service during 1936 and many other cities are now planning to use this modern "ride-on-rubber" vehicle.

Trolley Coaches in Service or Under Construction

City	Population	Number
Boston, Mass.	781,188	27
Brooklyn, N. Y. & N. Y. City	6,930,446	8
Chicago, Ill.	3,376,438	135
Cincinnati, Ohio	451,160	17
Cleveland, Ohio	900,429	20
Columbus, Ohio	290,564	38
Dayton, Ohio	200,982	42
Detroit, Mich.	1,568,662	6
Duluth, Minn.	101,463	18
Fitchburg, Mass.	40,692	7
Flint, Mich.	156,492	46
Greensboro, N. C.	53,569	12
Greenville, S. C.	29,154	9
Indianapolis, Ind.	364,161	152
Kenosha, Wis.	50,262	22
Knoxville, Tenn.	105,802	4
Louisville, Ky.	307,808	32
Memphis, Tenn.	253,143	14
Milwaukee, Wis.	578,249	30
New Orleans, La.	458,752	13
Pawtucket, R. I.	77,149	23
Philadelphia, Pa.	1,950,961	8
Portland, Ore.	301,815	120
Providence, R. I.	252,981	64
Peoria, Ill.	104,967	5
Rockford, Ill.	85,864	4
San Francisco, Cal.	634,394	9
Salt Lake City, Utah	140,267	26
Shreveport, La.	76,655	25
St. Joseph, Mo.	80,935	19
Toledo, Ohio	290,718	9
Topeka, Kan.	64,120	4
Youngstown, Ohio	170,002	25
Total		993

Inert Gas Controls Cable Sheath Oxide

Lead oxide inclusions at junction welds between successive press charges have caused many cable sheath failures and various means to avoid the difficulty have been developed. Here is described a method in which the lead is worked under an atmosphere of carbon dioxide

By W. T. PEIRCE
Electrical Engineer, American Steel & Wire Company

IN RECENT years great improvement in lead cable sheath has been accomplished by better press and die block design, by better press operation and by new techniques of production.* Among the latter are the continuous extrusion process, not yet widely applied, and methods for control of the lead in the press so that the metal will be kept clean and oxide prevented from forming in it.

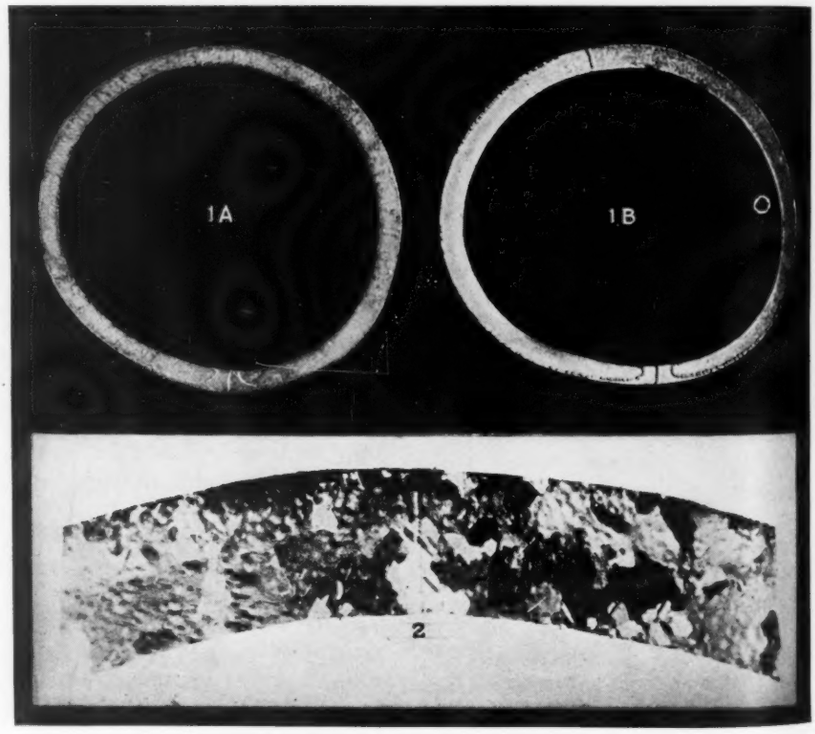
Three possible solutions have been suggested for the problem of oxide reduction. They are:

1. Reduction of the oxides in a reducing flame or gas atmosphere.
2. Prevention of oxide formation by maintaining the top of the lead container and the press under vacuum.
3. Prevention of oxide formation by maintaining the lead melting pot under a positive pressure of inert gas at all times and by flooding press container and lead ducts with the inert gas blanket before and during charging operations.

All of these methods have been tried out in practice and have proved effective in reducing oxide formation. But thorough study of the problem and its solution indicates to us that the third method possesses many advantages over the two others.

There are three major sources of oxide contamination—the pigs of virgin lead, the lead melting pot and spout and the lead cylinder of the press during charging operations. Each source must be controlled at all times if lead sheath is to be produced free of oxide. Since the lead in the melting pot must be kept for considerable periods of time at high temperatures where oxide forms readily, control of the lead pot is the most important.

Specially refined lead free of oxide is used exclusively for charging the melting pot. The pot consists of two chambers interconnected well below the surface of the lead. There is a small outer pot for the charging and melting of the pigs and a larger inclosed storage chamber. Any foreign material in the lead floats to the top of the outer melting chamber, where it can be removed readily by skimming. The clean lead flows through an aperture at the bottom of the chamber into the main storage pot, which is completely inclosed and kept under a positive pressure of from three to five pounds of inert gas.



Gas blanketing is effective

Fig. 1B shows the flow lines and welds produced in the former or usual manner without oxide control. The radial welds and flow lines are abnormally emphasized due to the action of the etching fluid on the sub-oxide area. While their visibility is by no means an indication of weakness at these points, the photo does show that oxide formation was not under effective control. Fig. 1A is a corresponding photograph of a section of lead produced under a gas blanket with oxide eliminated. Fig. 2 shows an annealed section of the same sheath. The growth of the crystals across the welds clearly indicates the perfection of the welds and flow lines.

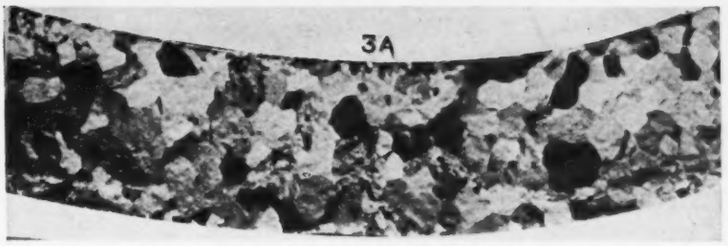
* Lead sheath for cable is produced by hot extrusion. In the usual method successive charges or fillings of lead are forced through die apertures under heavy hydrostatic pressure. In the formation of cable sheath by the usual vertical press the stream of lead is forced to flow around the die, thus forming a radial weld where the lead stream unites. There may be one weld at the bottom of the cable sheath, or two welds, one at the top and one at the bottom, depending on the design of the die block. Moreover, after each successive charging or loading of the press lead stands in the extrusion dies from both the old and new charge in varying proportions, causing definite flow lines indicating the junction of the two charges. Oxide inclusions in the lead tend to result in structural weakness because they form or collect on the surface of the charge and consequently appear in the junctions of successive charges.

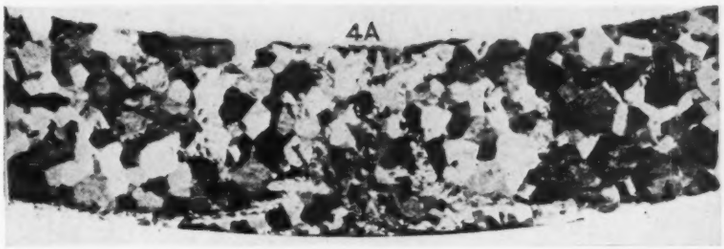
The lead pouring spout from the bottom of the main storage chamber to the lead cylinder is totally inclosed. In operation this spout is flooded with gas while the ram is being raised from the cylinder, thus flooding the press and filling the lead container as the ram emerges. The lead then flows into the container through this neutral atmosphere. The top of the cylinder is open for inspection during the charging period and is flooded with inert gas. While no oxide is formed in the inert atmosphere, the surface can be skimmed to remove the final possibility of carrying foreign material into the press. The ram can be inspected and cleaned after each charge. Thus the cable sheath is formed of lead that has been kept out of contact with all sources of oxidation from the time it is melted until it emerges as a solid sheath.

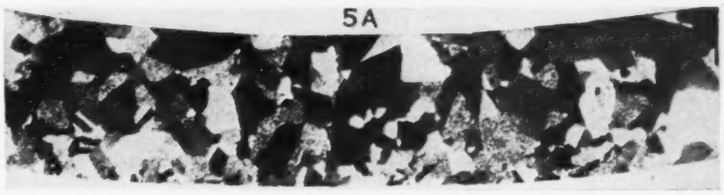
Since the prevention of oxide formation depends on the completeness of the gas seal, the proper choice of gas is important. Reducing gases are not suitable for the purpose, due to the explosion hazard introduced. There are several inert gases that may be used. Tests indicate that carbon dioxide with a slight carbon monoxide content is insoluble in the lead and will not react with it at operating temperatures. Carbon dioxide has the further advantages that it can be obtained free from oil and moisture at a reasonable cost and that its relative weight compared with air makes it ideal for use in flooding the lead press chambers.

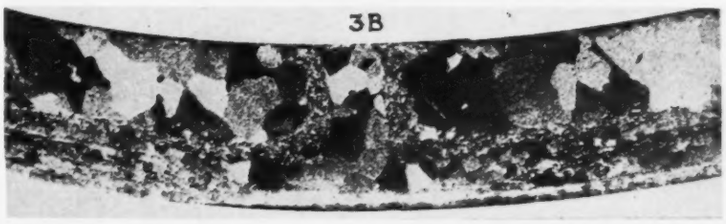
An important practical consideration in press operation is the application of pressure to the lead in the cylinder while it is cooling to the extruding temperature. The quick application of pressure not only avoids unnecessary exposure of the top surfaces of the lead, but aids materially in the formation of uniform crystal structure throughout the mass of lead. Therefore, the pumps operating the press must be of the best high-speed type to permit rapid manipulation.

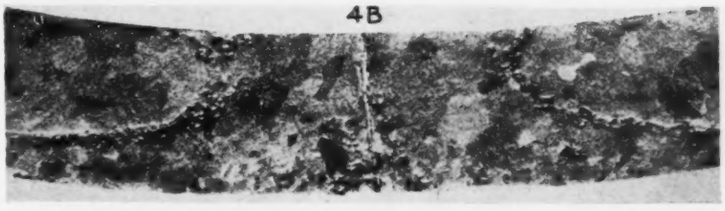
All of the accompanying microphotographs of carbon dioxide process sheath indicate the essential cleanliness of the lead and the complete absence of any substance that might contribute to the failure of the cable. The samples are all from the circumferential or charge weld region where the presence of oxides is most probable.

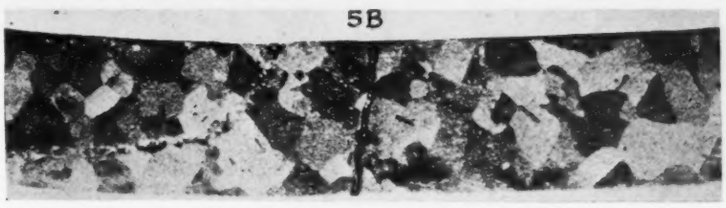












The improved process and the old

Figs. 3B, 4B and 5B are magnified sections of the bottom weld of regular process lead taken in the circumferential weld region. Figs. 3A, 4A and 5A are photographs from the same region of lead sheath produced with carbon dioxide control. In Fig. 3B the boundaries between the two charges of lead appear as bands of fine crystalline lead which close examination will show to be interspersed with traces of oxide. In Fig. 4B the boundaries are more distinct, but inclusions are of larger magnitude and more widely dispersed. Fig. 5B is an example of a prominent radial weld.

Fig. 3A shows the improvement obtained by the use of the carbon dioxide blanket over lead pot and cylinder. Weld and flow lines are barely distinguishable and crystal growth takes place freely across them, demonstrating the complete absence of pronounced oxide inclusions. Fig. 4A is another section further along in the charge. Here, again, no inclusions can be noted in the lead; the whole weld region is well knit and of uniform grain size. Fig. 5A is a fine example of the perfect weld obtainable with carbon dioxide control. Considerable study is necessary before the weld line can be detected.

Editorials

HOWARD EHRLICH . EDITOR

Private Distribution of Public Power Wins Again

ONCE MORE the people of San Francisco have voted their unwillingness to exchange the present advantages of private ownership for municipal ownership. The election two weeks ago, while it was but one more of several futile attempts of government ownership advocates to secure approval of the electorate to the purchase of the Pacific Gas & Electric distribution system, has a larger significance.

Politically developed Hetch Hetchy power by statute was not to be sold to private utilities. For more than ten years, however, San Francisco has permitted the marketing of this power over the Pacific Gas & Electric system, selling power to the company at wholesale under a "temporary" agreement. Apparently the people are well satisfied with this arrangement, and that it means continued violations of the spirit of the Raker Act seems to be worrying San Franciscans not a whit.

As one marketing committee after another seeks ways and means of selling the output of Bonneville and the T.V.A. dams, Hetch Hetchy power is being sold under an eminently satisfactory agreement, in the judgment of the voters. If the Raker Act is a threat to a working agreement that provides a satisfactory market for Hetch Hetchy power, it would seem time now for the people of the San Francisco area to be given a chance to register their disapproval of the Raker Act.

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Forecasting and System Planning

ANY FORECASTER who places a French curve against the last ruling segment on a system load curve can make queer forecasts. Such, however, is not forecasting; it is crystal gazing.

Thus, in one particular case a 1915 forecaster indicated infinite load soon after 1925; ten years later the forecast indicated a delay of definite load until 1940. After another ten years (1935) it looked as though saturation would be reached by 1945 at a load 10 per cent less than it turned out to be at the beginning of 1937.

Forecasting is the predicting what the load will be in certain future years. When done broadly for the system as a whole, it can be indicative of the probable future demands for additional capacity and capital. For system planning, however, more detailed forecasting is necessary. Where will each new component of load occur, how much will it be and what will be its annual and daily load factor characteristics? When these details are known it is possible better to plan the scheme for stations, lines, substations, network and general distribution. Then, if the forecaster can predict also the new load revenue, it will be possible to determine in advance how much can be spent to handle it and the profit estimated.

Few such forecasts have been made. More will have to be if the best results in the way of return and service are to be secured from the invested dollar. From planned load building will come reasonably accurate and detailed forecasts, and with these the system planners can be ready at all times to take care of the demands of new load at any point.

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Load Building Still Speeds Ahead

A LITTLE study of the survey of domestic load building in this issue discloses a lot of food for thought. This is the seventh semi-annual tabulation and analysis of power company and dealer appliance selling activities. It presents a graphic picture of what the individual companies are doing. It writes a fine record of accomplishment.

Last year the merchandise sales of the 110 reporting companies, that themselves sell appliances, increased by 22 per cent, and this was on top of a 21 per cent increase in 1935 over 1934. In a word, it means that these companies are accelerating at a rate that, if maintained, will more than double their volume in four years. To achieve this progress they expanded their sales organizations by 18 per cent, increased their expenditures for promotion by 13 per cent and improved their methods. And what the leading companies are accomplishing this way should be an inspiration to the entire industry.

As a matter of fact, it is. And that is what has made the laborious compilation of these surveys worth while. In each survey a few glaring cases stand out, of cities where the local practice is way behind current progress. Then six months later improvement is shown. It reveals the zeal with which sales management is now scrutinizing its own operations.

Perhaps the most significant feature of this survey, however, is the continuing growth in dealer sales. The evidence is limited by the unfortunate inability of so many companies to estimate what the local dealers are actually selling. But it is sufficient to show that the independent retailer is fast becoming an important influence in load building.

This lack of knowledge of what the dealers are loading onto the lines and of the existing saturations of the major appliances is still a weak spot in sales control in many cities. It indicates one of the most

important steps yet to be taken by utility sales executives in the further improvement of their sales planning and management. For accurate knowledge of the market is a basic need. Strangely enough, the 23 non-merchandising companies know little more of their existing major appliance saturation than is known in the other cities.

As before, the non-merchandising companies report average consumptions and revenues that follow close behind those of the other group. But the most rapid advances are coming in cities where the power company is actively selling, a leader in the trade. Clearly, load can be built through two channels. It is the creation of public demand that counts, no matter where people buy their appliances.

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Elihu Thomson

THE last of the great pioneer inventors who gave to the modern electrical industry its beginning was Elihu Thomson. While his name has not had the same popular renown as that of Edison or Bell, his contributions to the public welfare have been no less important. He was laying the groundwork for alternating current years before it came into general use. Large industries have come into being as a result of his discovery of resistance welding. Before Hertz he was sending signals without wires. The repulsion motor, recording wattmeter, oil-cooled transformer, induction regulator, constant-current transformer, magnetic blow-out lightning arrester, three-phase dynamo and many hundreds of other electrical inventions, besides a large number in other fields, such as the centrifugal separator, quartz mirror, uniflow steam engine, have contributed greatly to the growth of industry, labor, human happiness and knowledge.

Nevertheless, largely because of his retiring disposition, which caused him naturally to shrink from publicity, he was little known among the general public. On the other hand, the world of science and engineering honored him for what he was. The first one to receive the Edison medal, he was the only one ever to receive all three of England's highest scientific honors —the Hughes, Kelvin and Faraday medals. There were also the John Scott medal twice, the John Fritz medal, the Franklin medal and the medal of the Verein Deutsche Ingenieure, Germany's highest award in the engineering profession. Besides, there were honorary degrees, foreign decorations, prizes and the highest offices in national and international scientific and engineering bodies.

Since Thomson and his young contemporaries of the early '80s made their discoveries, there have been improvements and refinements, but the fundamentals of a half a century ago are the fundamentals of today. So that while with the passing of Elihu Thomson the industry has lost its last personal tie with its conception, it can never lose the imprint of his thinking.

Flood Control and Power

WHAT is the relationship between flood control and power generation? Are they Siamese twins or is there a degree of independence? If independent, which is of primary purpose in developing a waterway and how far should the incidental or secondary purpose be allowed to influence the engineering and cost necessary to accomplish the primary objective?

These are questions for the government to answer in clarifying its national power policy. Flood control is a natural activity of a national government, but there is a great question as to whether power development as a primary objective is a proper function of government, especially when it places government in the position of being a marketing agency.

Almost any flood-control project can be made into a water-power project, but would that always serve to provide the best flood control? If a power project is to produce marketable power, it must have a supply of firm power, not merely power when and if the river rises. Firm power means the impounding of water in reservoirs. If the dams are made high enough and strong enough, they may also act as impounding basins in times of heavy runoff and so act to control floods. But how much more would the cost of such super dams be than the cost of dams solely for power purposes? And then would this excess cost be more or less than the cost to construct flood basins were the project solely one of flood control? And, finally, yet most important of all, which method would provide the greatest degree of safety from the hazards of floods?

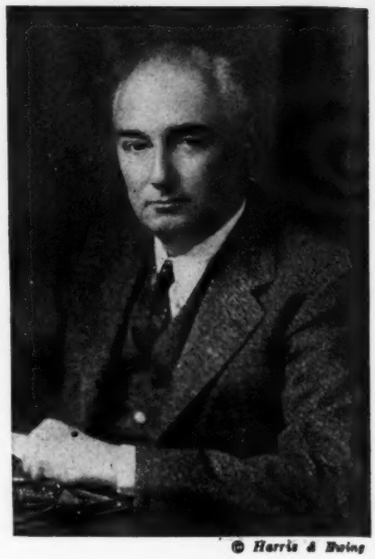
There is a popular feeling that water power is cheap because, once the plant is built, old mother nature supplies the fuel, through falling water, without charge. What the public does not know is that all of the government sites have been studied by private industry and rejected as being uneconomical. In other words, steam-generating stations located closer to the market are more economical.

The experiences of this spring along the Ohio River and of several previous years in different sections of the country indicate the pressing need for flood control. This can be accomplished for a reasonable amount of money in comparison with the sums expended for unemployment relief. But to accompany these projects with development of firm hydro power will increase these costs well beyond the capacity of the public purse.

As an example, the army engineers estimated the annual flood damage in the entire Tennessee Valley to be approximately $1,800,000. An insurance fund at 3 per cent interest to provide for such damages would cost but $60,000,000. Navigation at the army engineers' figures would cost but $75,000,000. The entire TVA project, however, is to cost but slightly less than $500,000,000. Obviously, the tail cannot continue to wag the dog if we are to make any material headway in flood control.

Flood Control and Power Cannot Mix

By CARTER FIELD



© Harris & Ewing

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

MORE trouble and controversy over TVA is written on President Roosevelt's engagement book. It seems unavoidable. For one thing Dr. Arthur E. Morgan, after careful study of the whole situation, has decided to go further, in public, even than he went in ELECTRICAL WORLD a few issues back, when he told the readers of this magazine that not only had he put a plaque on one of the dams in the Miami (Ohio) Conservancy District saying this must never be used for the generation of power, but he would like to put one down at TVA, saying—thus far and no further.

Morgan will not resign

He now takes the flat position that in view of the seriousness of the flood situation in this country the various projects should be concentrated on flood control, rather than for the generation of electricity! The point being, of course, that the same water storage power cannot be used for both flood prevention and power production. *PART* of the capacity behind a dam can be used for each, but they are *two different* parts. Obviously the best service a reservoir can render for flood prevention is to be *empty* when the rains commence—which is utterly at variance with the ideal of a continuous flow so vital in power production.

All of which might be academic, for the moment, except that Dr. Morgan has fully recovered his health, is in a fighting mood, according to close friends just back from TVA headquarters, and *will not resign.*

Meanwhile David E. Lilienthal, bucked up by the President's support, and by assurances from his liberal senatorial friends that they are behind him, has no thought of quitting either. And Lilienthal's chief idea is to use TVA not only for the production of electric curernt, but to supplant the private electric business in so far as he is able.

It is the old story of the irresistible force and the immovable body, for there is a curious bit of background in this story which most people never knew, or have forgotten. The point is that the President cannot remove Dr. Morgan!

It seems that when Uncle George Norris and his public ownership partisans in the Senate were framing the original bill they were not as sure as they have since become that the President of the United States would be on their side as long as might prove necessary. To put their thought in the words recently used by Senator Burton K. Wheeler in connection with the Supreme Court packing proposal: "Suppose we have another Harding?"

So they decided that Congress, and not the President, should have the power to remove a TVA commissioner.

Of course it would be very simple for President Roosevelt to force through Congress a resolution removing Dr. Morgan—*if*—it were not for the Supreme Court proposal, and *if* it were not for the government reorganization proposal.

But the last thing the President wants to do at the moment is to take on any more trouble on Capitol Hill, either in the way of new fights or in the way of new subjects for debate. Best opinion seems to be that the Supreme Court fight will run until June or July, maybe longer. Any other controversial subject injected during that period will just be grist for the mills of his opponents on the court issue. Not because the same men would oppose him on the court and on Morgan's removal—Senator Norris himself is loath to vote for the court enlargement, but would be eager for Morgan's removal. But it would be something else for senators to talk about, and if there is one thing that is clear about this court fight, it is that there is very little chance of cloture. Senators will be permitted to talk as long as they want, and in many instances much longer.

Meanwhile, however, Harcourt Morgan continues to vote with Lilienthal, so Dr. Morgan continues to lose each vote, two to one. But there is a nervous feeling among Lilienthal's friends that Harcourt just might discover it to his interest to switch—that he might discover he could get more of the things he wants TVA to do if he went along with the other Morgan than by continuing to go with Lilienthal.

Taxes will increase

With the next election a long way off it is rather curious that so few senators and representatives are willing to look the tax situation in the face. Marriner Eccles of the Federal Reserve system and Senator Robert M. La Follette of Wisconsin are among the few men in official life in Washington who are telling the country the truth on this subject. It is perfectly obvious to any one who pays any serious attention to what Franklin D. Roosevelt wants to do, and proposes to do, that there *must* be precisely what Governor Eccles said in a recent newspaper statement—higher taxes on corporation profits and large individual incomes. Senator La Follette agrees that public spending will *increase*—not *decrease*, but differs in

[*Continued on page 110*]

Letters TO THE EDITOR

What Price Incremental Energy

To the Editor of ELECTRICAL WORLD:

We should like to comment briefly on certain observations, quoted below, from page 64 (unnumbered) of the January 2 issue of the ELECTRICAL WORLD.

"On the preceding page it was pointed out that the average domestic usage increased from 673 kw.-hr. to 720 kw.-hr. and the average domestic bill from $33.85 to $34.28.

"There may be food for thought in the observation that 'the average customer,' nonexistent though he is, purchased 47 more kilowatt-hours in 1936 and paid only 43 cents more for them. One way to look at the proposition would be to say that the new domestic load added this year, on the whole brought in only 9.15 mills per kilowatt-hour."

This looks like a play on averages, which is the most treacherous procedure we know. According to our best information, the significant 1936 changes in the national domestic load were as here shown:

	1935	1936	Change
Average number of domestics served	20,779,101	21,352,000	+572,899
Domestic kw.-hr. sales	13,978,038,000	15,375,000,000	+1,396,962,000
Domestic revenue received	$702,683,000	$728,200,000	+$25,517,000
Avg. monthly sales per customer	56.06	60.01	+3.95
Avg. monthly rev. per customer	$2.818	$2.842	$+0.024
Avg. rate per kw.-hr.	5.027	4.736	−0.291
Increased revenue per avg. customer month per increased avg. kw.-hr.	.....	.....	0.00608
Saturation of Appliances in Active Use	Per Cent	Per Cent	Per Cent
Radios	74.20	81.96	+7.76
Refrigerators	28.30	34.42	+6.12
Ranges	4.64	5.17	+0.53
Water heaters	1.15	1.33	+0.18

The difference between the 9.15 mills incremental revenue quoted and the 6.08 mills shown in the table arises from the use of a customer count as of December 31 in your article, as compared with the annual average count based on E.E.I. figures used by us. Now when this tabulated data are applied to Public Service Company of Colorado's block analyzing machine the national distribution curves shown in the accompanying illustration are obtained for the two successive years.

We next "spot check" these curves as follows, to test their accuracy as truly representative of the nation's load. When the domestic rate schedules effective during 1935 and 1936 in certain cities of 100,000 or greater population are applied to these estimated national curves, various weighted average unit rates are calculated, as tabulated in Table I. These particular cities were selected from the Federal Power Commission's Rate Series Report No. 1 as having "median" domestic rate levels and, in addition, because each had a pure block rate.

These figures indicate that the actual reported decline of 5.6 per cent in the domestic rate of the nation during 1936 is well in line with the average of 5.3 per cent decline estimated for the six typical cities named. Such a test would therefore seem to justify our acceptance of the estimated distribution curves as the basis for further observations regarding the 5.8 per cent change.

1. Causes of the Reduction—The 5.8 per cent rate cut that was reported came from two separate forces that were independently at work

(a) 1.75 per cent (approximately one-third of the rate cut) came from the inherent load-building characteristics of the rates under changing load. The mathematics of this comes from Table I, for:

$$\frac{1.0-0.984}{1.0-0.947}\ (1.0-0.942) = 0.0175 = 1.75\%$$

(b) 4.05 per cent (the remaining two-thirds of the total reduction) came from lowered schedules made effective by the utilities themselves.

2. Estimated Incremental Revenue Obtained from the Incremental Sales—Had there been no lowering of schedules, the average domestic rate in 1936 would have been 5.027 x (100.00—1.75) = 4.939 cents. And consequently, under those circumstances, the revenue comparison between 1936 and 1935 would actually have been:

For 1936 Revenue =	15,375,000,000 kw.-hr.	× 0.04939 =	$759,371,250
For 1935 Revenue =	13,978,038,000 kw.-hr.	× 0.05027 =	702,683,000
Inc. 1936 over 1935	1,396,962,000	× 0.0406 =	$56,688,250

This indicates that the incremental energy was probably sold at an average of around 4.06 cents, or at 81 per cent of the average price of the total domestic energy sold in the previous year.

3. Changes in Consumption Habits of the Customers—Through the medium of the "block analyzer" referred to, we estimate that the following changes in billing distribution of the load occurred:

Number of Bills Rendered Between Consumption Limits

	(0–10) kw.-hr. Inc.	(11–36) kw.-hr. Inc.	(37 and over)
1935	13,581,000	124,965,000	110,803,212
1936	11,312,000	117,357,000	127,555,000
Increase, 1936 over 1935	−2,269,000	−7,608,000	+16,751,788

The significance of these data is that due to increased appliance saturation some 3.8 per cent of the bills rendered in 1936 moved "up scale" out of the high rate brackets (0 to 36) kw.-hr. and into the lower priced steps above.

4. Here Are Four Prices for the Incremental Energy, Choose the One Which Suits Your Purpose Best.

(a) ELECTRICAL WORLD, based on year ending customers:

$$\text{Rate} = \frac{\$34.28-\$33.85}{720 \text{ kw.-hr.}-673 \text{ kw.-hr.}} = \$0.00915$$

[*Continued on page* 110]

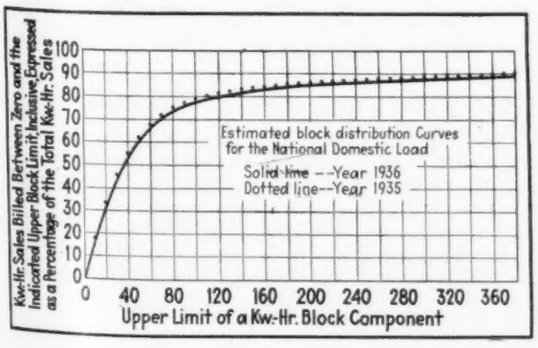


Table I—Calculated Weighted Average Unit Rate per Domestic Kilowatt-Hours Based on Schedules in E.E.I. Rate Book

	1935 Rates			1936 Rates	
City	1935 Distribution Curve, Cents	1936 Distribution Curve, Cents	Ratio: 1936 to 1935	1936 Distribution Curve, Cents	Ratio: 1936 to 1935
Canton, Ohio	4.982	4.881	0.980	4.450	0.893
Philadelphia, Pa.	4.855	4.769	0.982	4.430	0.912
Syracuse, N. Y.	4.228	4.138	0.979	4.138	0.979
Seattle, Wash.	3.804	3.699	0.972	3.442	0.905
Indianapolis, Ind.	5.478	5.449	0.995	5.449	0.995
Columbus, Ohio	4.467	4.432	0.992	4.432	0.992
Avg. total group	4.636	4.561	0.984	4.390	0.947
National reported average	5.027	.....	.....	4.736	0.942

News OF THE WEEK

American Light & Traction Files Registration Under Utility Act

Action is expected to solve problems of unit in United Light & Power system — Landis says S.E.C. is gratified with step — Assets of registered holding companies now representing 28 per cent of the industry

Steps toward simplification of the United Light & Power Company system were taken last week when one of its subsidiaries, American Light & Traction Company, notified the Securities and Exchange Commission that it would register under provisions of the utility act. This action was taken following conferences between Charles S. McCain, president, and S.E.C. Chairman James M. Landis.

Recently American Water Works & Electric Company and the North American Company registered under the utility act. With American Light & Traction registering, Mr. Landis said that the total assets of registered holding companies is approximately $4,700,000,000, which represents about 28 per cent of the assets of the industry. If the other companies in the United Light & Power group register, which action is expected, this percentage would be approximately one-third of the industry.

Work out problems

Mr. McCain stated that "by this procedure we expect, with the co-operation of the commission, to work out some of our problems in conformity with provisions of the utility act and to the best interest of our investors and the public which we serve." As of December 31, 1936, subsidiaries of United Light & Power had outstanding funded debt of $223,028,600. At the same time the parent company funded debt was $38,695,600.

American Light & Traction controls twenty subsidiary companies operating in New Jersey, Michigan, Wisconsin and Texas.

Mr. Landis stated that the commission is gratified to see the company take this step. "I think this is a further evidence that the operating heads of the holding companies are becoming increasingly aware of the fact that registration under the act is sound and practicable," he said.

It is expected that American Light & Traction, as well as other units in the United Light & Power group, will soon undertake a refinancing program to effect savings in interest charges.

•

TVA Flood Control Refuted by Kellogg

Statements made by Senator George W. Norris of Nebraska purporting to show that the TVA dams had been effective in preventing a flood on the Tennessee River in late January and early February and in ameliorating the flood stage at Cairo caused by the recent Ohio flood were refuted by Charles W. Kellogg, president of the Edison Electric Institute.

Mr. Kellogg stated that Wheeler and Norris are the only two dams completed to date by the TVA. He said that the Wheeler Dam is a "run-of-river" dam and can therefore have no appreciable effect in flood control. Norris, Mr. Kellogg said, can serve to a limited extent to control floods, but only if used properly for that purpose and not for production of firm power.

TVA, in a press release, stated that during January, when serious floods occurred on the Ohio river, approximately three times the normal rainfall, or approximately 13 inches, was recorded in the area above Norris on the Clinch River and more than 23 inches fell along stretches of the lower Tennessee at the same time.

It was also stated by TVA that during the fifteen-day critical period the two dams withheld 32,000 cubic feet of water per second from the stricken areas.

A Weather Bureau map was produced by Stephen M. Walter of Washington showing rainfall in the TVA and the flood area. Mr. Walter stated that the headwaters of the Clinch River served by Norris Dam fall almost wholly within the zone of four-inch normal rainfall. He said that the conclusion from weather reports is that rainfall had been only slightly above normal in most of the watershed and that there could have been no flood danger.

Mr. Kellogg pointed out that the flood on the Tennessee was too small to test the effectiveness of Norris Dam. He said that the effectiveness of Norris was very slight because it was so nearly full when the flood came. "It takes empty reservoirs, not full ones, to catch floods, but when empty they would produce no power," Mr. Kellogg declared.

•

Gain in Air-Conditioning Units Shown by Chicago

Capacity of air-conditioning installations contracted for in Chicago in February set a new high record, according to Commonwealth Edison Company. Thirty-three air-conditioning plants with a total capacity of 1,972 hp. were contracted for, which represented an increase of 57 per cent over a year ago. At the end of February 1,418 air-conditioning plants had been installed or were under contract in Chicago.

Federal Power Projects Opposed as a Justified National Necessity

Nation-wide poll of country newspapers reveals editors do not favor municipal ownership of electric plants — Vote 977 to 224 against "death sentence" in utility act—Utilities held giving good service

Belief that government or municipal ownership of electric utilities would not give more progressive, more efficient or cheaper service when tax exemption and tax subsidization are taken into consideration has been overwhelmingly expressed by editors of country newspapers throughout the country.

In a nation-wide survey conducted by the publishers of *Industrial News Review*, E. Hofer & Sons of Portland, Ore., it was found that the country newspaper editors were strongly opposed to municipal ownership and were nearly unanimous in their declaration that the private electric industry is giving good service. By a vote of more than six to one the editors declared that government utilities would not give better service than private utilities.

The editors voted 1,005 to 267 against the proposition that federal electric developments are justified as a national necessity. State regulation of the utilities was held to be successful.

The vote against the wholesale "death sentence" in the utility act for holding companies was 977 to 224, with both Montana and Texas, the home states of Senator Burton K. Wheeler and Senator Sam Rayburn, sponsors of the utility act, opposing the provision.

Great significance is attached to the returns from Tennessee, Mississippi, California, Montana, Washington, Oregon, Wyoming and Alabama, in which editors were opposed to the federal hydro-electric projects, which might be presumed to expect unusual benefits from the developments now under construction or just completed.

The survey was conducted last December and constituted one of the weekly comments on basic questions affecting industrial development, including questions pertaining to investment, finance, employment, wages and taxation to newspapers in the smaller towns and country districts in every state.

Tabulation of Answers from Editors to Questionnaire On Electric Power Industry

1—Do you favor municipal ownership of power plants?
2—Do you think federal electric developments justified as a national necessity?
3—Do you think state regulation has been a failure?
4—Do you think the electric industry is giving good service?
5—Do you believe that government or municipal ownership of the industry would give more progressive, more efficient or cheaper service — tax exemption and tax subsidization of government projects being taken into consideration?
6—Are you favorable to the wholesale "death sentence" for holding companies?

State	No. of replies	1		2		3		4		5		6	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Alabama	15	2	12	3	11	7	7	14		3	12	2	12
Arizona	6	3	3	4	2	6		6		3	3	3	3
Arkansas	23	7	16	9	13	8	13	22	1	3	19	5	18
California	66	5	56	9	51	21	33	61	1	2	56	9	47
Colorado	25	3	22	3	21	9	12	24		2	21	4	19
Connecticut	9	4	5	3	6	4	5	8	1	3	6	3	6
Delaware	1	1		1		1		1	1	1		1	
Florida	16	11	5	7	9	6	4	13	1	5	5	3	13
Georgia	15	4	11	4	11	3	9	14		1	12	1	13
Idaho	18	1	16	2	16	4	14	16	1	1	17	1	15
Illinois	77	13	63	12	63	29	35	69	3	8	66	11	63
Indiana	38	11	19	6	30	20	13	33	2	6	25	8	26
Iowa	73	15	57	12	60	23	33	68	2	5	62	7	60
Kansas	60	24	35	10	50	8	47	56	4	5	47	13	43
Kentucky	17	6	10	7	9	9	6	14	1	6	8	4	10
Louisiana	8	1	7	1	7	2	5	8			8	2	6
Maine	8	3	5	2	5	3	3	8		1	5	1	6
Maryland	7	3	4	2	5	2	5	6		1	4	1	6
Massachusetts	22		19	2	19	10	10	20	1	2	19	1	15
Michigan	28	5	23	2	26	8	18	27	1	2	26	4	23
Minnesota	71	23	44	16	51	29	30	67	3	13	53	18	46
Mississippi	12	3	8	6	5	3	6	12		3	9	1	10
Missouri	70	19	51	10	52	23	38	63	3	14	51	10	51
Montana	12	5	7	4	8	5	7	10		5	7	2	9
Nebraska	56	24	32	11	44	19	28	54	1	11	40	6	42
Nevada	3		3	1	2	1	2	3			3		3
New Hampshire	5		5		5		5	5			5		5
New Jersey	31	3	17	6	24	11	16	30	1	4	25	4	25
New Mexico	7	1	5	1	4	2		5		1	5		5
New York	64	8	56	8	53	22	28	60	2	1	59	11	50
North Carolina	12	3	9	4	7	5	4	12			10	3	7
North Dakota	31	14	17	7	22	12	17	29	1	7	23	6	22
Ohio	43	15	28	8	35	20	20	42	1	7	35	7	36
Oklahoma	39	7	32	11	28	18	16	38	1	8	31	9	28
Oregon	34	4	30	7	27	11	18	33	1	2	30	8	23
Pennsylvania	38	6	31	5	33	18	15	38		3	32	5	33
Rhode Island	2		2		2		2	2			2		2
South Carolina	10	2	8	3	7	3	5	8		1	7	1	9
South Dakota	28	5	23	5	21	15	10	23	1	1	24	4	19
Tennessee	11	2	9	2	8	4	4	10		1	10		11
Texas	74	7	58	15	54	29	28	69	1	7	55	17	49
Utah	5		5	1	4	2	1	5			5	2	3
Vermont	2		2		2		1	2			2		2
Virginia	13	4	8	6	7	2	7	12	1	4	7	4	8
Washington	38	9	29	9	29	11	23	36		6	31	8	23
West Virginia	7	2	5	1	5	1	3	6			6		6
Wisconsin	39	11	28	6	33	12	19	35	2	4	32	10	26
Wyoming	8	3	4	1	6	6	2	6		2	5		6
Miscellaneous	19	5	13	6	13	11	6	17	2	3	15	4	14
Totals	1,316	307	957	267	1,005	477	633	1,219	41	168	1,040	224	977

Appalachian Company Sponsors Rural Plan

One of the greatest rural development projects sponsored by the Appalachian Electric Power Company will be carried out this year, according to an announcement made by J. P. Gills, manager of the Bluefield district. Approximately 500 miles of line is to be built in the Bluefield division and about 200 miles will be erected in the Bluefield, W. Va., division. An even greater development will be carried out in the Pulaski district.

Appalachian Electric is going in for rural development on a very elaborate scale and will bring to those living in the rural districts modern city conveniences at a rate no higher than that which prevails in the cities and towns serviced by the company.

Order Approves New Plant

An amended order has been issued by the New York Public Service Commission approving the construction of a gas and electric plant in the village of Manchester by the Rochester Gas & Electric Corporation. The company was also given authority to exercise a franchise granted to it by the Board of Trustees of the village of Manchester.

Engineers for Part In National Affairs

Overwhelming sentiment among the rank and file of professional engineering societies that these societies should take effective public action in national affairs of an engineering nature in their respective fields was indicated by a vote taken at a joint meeting last Monday of the Chicago Section, American Institute of Electrical Engineers and of the Electrical Section, Western Society of Engineers.

The vote followed the presentation and discussion of two papers, the first of which by P. B. Juhnke, A.I.E.E. director, brought out the urgent compulsion which is on the engineer, as representative of his profession, to participate in efforts to solve economic and social problems. After this larger statement of the matter, Frank R. Innes, ELECTRICAL WORLD, spoke on the aspect of the situation which is of particular concern to the electrical engineer, electric power in politics as manifested in the errors and fallacies of the water power program of the government.

Prepared discussions were presented by Jr. R. Van Pelt, president, Western Society of Engineers, E. G. Fox, Freyn Engineering Company, W. W. De Berard, *Engineering News-Record*, and A. M. McCutcheon, president American Institute of Electrical Engineers.

The meeting went on record as favoring this type of meeting, and that the professional engineering society should take vigorous, effective action in regard to public affairs and broad economic problems that lie within its particular field.

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Great Lakes Group To Meet in Chicago

The Great Lakes Power Club has called a meeting at the Edgewater Beach Hotel in Chicago on April 2, which is the day immediately following the spring sales convocation of the Edison Electric Institute at the same place, to discuss the need for material advertising of commercial power. The idea is, of course, that men attending the E.E.I. sessions will stay over for another day to hear about the advertising project.

At the Power Club meeting previous efforts to get an advertising program started will be reviewed to show the background of interest behind the present activity. Then a presentation of the need for advertising and of methods and means will be made by Klau-Van Pietersom-Dunlap Associates, the agency retained by the Great Lakes group. It is hoped that the meeting will result in the formation of a national body to be named "Associated Power Clubs," "Commercial Power Development Association" or the like to sponsor and to handle the work of national advertising. A large attendance of the country's leaders in commercial and industrial power sales is expected.

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Utah Power & Light Holds Sales Meeting

Gathering in Salt Lake City for the first general sales conference of its kind ever held by the Utah Power & Light Company, residential, commercial and industrial salespeople met recently for a six-day discussion pertaining to commercial sales activities.

Members of the Western Colorado Power Company, the Bountiful Light & Power Company, dealers, wholesalers and manufacturers were invited to the conference. G. M. Gadsby, president; P. M. Perry, vice president and commercial manager, and W. A. Huckins, sales manager, of Utah Power, discussed the company's position in the sales activities. Mr. Gadsby stated that during the year $782,047 in additional estimated revenue was added to the utility's lines. Major appliance sales of both utility and dealer showed substantial gains.

The utility has set a goal of $1,012,000 for appliance sales this year. Plans are to sell an average of 100 major appliances a day. Last year sales of both dealer and utility totaled 3,553 ranges, 11,089 refrigerators and 980 water heaters.

•

Wins Sit-down Strike

Nebraska's first sit-down strike was won by Millard Johnson of Stockville, owner and operator of the local light plant, when he recently closed his plant for three hours when the town board refused to tear down the wires of a rival plant. The board called a hurried meeting and acceded to his demands. When the wires came down Johnson restored power to the city.

Oust Indiana Mayor on Electricity Plan

Impeachment of Mayor Clare W. H. Bangs, who waged a long and fruitless battle for municipal operation of an electric light and power plant, has been voted by the Huntington, Ind., City Council.

Mayor Bangs was found guilty on fourteen of the nineteen charges filed before the Council on July 28, 1936. Statutes provide an appeal must be made to the Circuit Court.

Mayor Bangs was in jail many months on a contempt of court conviction because he refused to abide by a court order. He passed more than 100 days in jail in 1935 as a result of his fight to establish a municipal electric plant in competition with the Northern Indiana Power Company.

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Ontario Acts to Aid Abitibi Power Plan

Attorney-General Arthur Roebuck told the Ontario Legislature this week in introducing a bill affecting the bankrupt Abitibi Power & Paper Company that reorganization is closer to realization now than any time since the company failed.

It was stated that the government was eager to remove all obstacles in the path of reorganization of the company, and one of the first steps would be to clear up the company's position with regard to the government-created Hydro-Electric Power Commission.

The claims held by the commission against Abitibi would be exchanged for certain assets given by the company.

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P.W.A. Grants $150,000 for Work on Buzzard Roost

The Public Works Administration has approved a requisition for $150,000 to be used on preliminary work for the Buzzard's Roost hydro-electric project of Greenwood County, S. C. The amount will be charged against a $2,852,000 allotment made two years ago, but since tied up by a suit brought by the Duke Power Company. Terms of the injunction permit the expenditure of not more than $150,000 for legal, administrative, conservation and engineering costs before a final decision is reached.

New England Power Units Plan Merger

Utility properties in Worcester County, Massachusetts, representing plant investment costs aggregating $13,097,000 came before the state Department of Public Utilities this week in support of the merger of the Worcester Electric Light and Webster & Southbridge Gas & Electric companies, with the formation of a new corporation, the Worcester County Electric Company, to carry on the service of the proposed enterprise.

John T. Noonan, for the petitioners, which are affiliated with the New England Power Association, informed the board that substantial economies would result from the merger in the direction of simplifying bookkeeping, eliminating burdensome governmental reports, handling supplies and utilizing man-power. These economies, he declared, are expected to make rate reductions possible in the areas served by each company, although zone rates will probably be necessary on account of the great differences in territorial density between Worcester and the outside county towns concerned.

Plans for the merger include the issue of 96,000 shares of $25 par stock for an even exchange for the existing Worcester Electric Light stock now in the treasury of the New England Power Association. The Worcester company serves one town and sells to two others besides operating in the city of Worcester, while the Webster company serves nine towns with electricity. The former has 58,059 customers and the latter 12,340 electric and 7,056 gas customers. Worcester purchased about one-third of its output and Webster purchased about 96 per cent of its output from New England Power. Opposition was voiced by W. C. Marshall, counsel for customers of the Webster company, pending conferences to bring out more details of the program. At the suggestion of Chairman A. C. Webber the interested parties agreed to confer informally, municipal authorities and company representatives to meet at the commission's offices in the hope of ironing out differences before April 7, when the next hearing is scheduled.

•

Arkansas Power Rural Plan Held In Abeyance

Application of the Arkansas Power & Light Company for permission to build a transmission line from a point near Altheimer to the Lake Dick Reconstruction Administration project has been held in abeyance by the Department of Public Utilities until current demand from the project can be determined. It was found that the R.E.A. contemplates construction of a line to serve the same area.

•

Electric Sales in Illinois

Total sales of electric energy to ultimate consumers in the state of Illinois in February totaled 588,337,855 kw.-hr., compared with 530,844,158 kw.-hr. in the corresponding month of 1935, an increase of 10.8 per cent. Compared with January, however, sales decreased 35,385,485 kw.-hr., a drop of 5.7 per cent.

Pacific Gas Adopts Age Retirement Plan

Pacific Gas & Electric Company has adopted a pension plan, operative as of January 1, under which employees will be able to retire with an assurance of old age security. Participation in the plan is optional with the employee, who contributes a monthly deduction of a small salary percentage to the insurance fund, while the company contributes an equal amount. The insurance has been placed with the Prudential Insurance Company of America and the Metropolitan Life Insurance Company, each to assume 50 per cent of the liability for the annuities.

Retirement age will be 60 years for women and 65 for men and retirement is to be compulsory unless the employee is requested by the board of directors of the company to continue in active service. Annuity payments begin at the date of retirement age.

Every employee is amply protected in his contributions to the funds. If his service is terminated for any reason prior to his eligibility to retire under the annuity plan, he may withdraw all his contributions in cash. If he has had ten years of continuous service and has passed his fiftieth birthday, he may leave his contributions with the insurance company and on the normal retirement date receive the income from both his own and the company's contributions up to the date his service was terminated. Or, if his service has been less than ten years and he has passed his fiftieth year, he may leave his own contribu-

SALES CONFERENCE—A six-day sales conference was recently conducted by the Utah Power & Light Company at Salt Lake City, attended by its staff and those of the Western Colorado Power Company and the Bountiful Light & Power Company. Dealers, wholesalers and manufacturers were also invited to participate in the discussions. The gathering was the first general sales conference of its kind ever held by the utility and marked the opening of a progressive campaign.

tions with the insurance company and on the normal retirement date receive monthly income for life beginning at his normal retirement date.

In the event of the death of an employee after his retirement, any excess in the amount of his contributions over the amount of retirement income he has received will be paid to his beneficiary.

There are many other points in connection with the plan giving the employee his option on the manner by which payments shall be made and their amount.

As this plan went into operation January 1, it does not apply to any past service. The company itself proposes to pay annuities to old employees who are now of retirement age. All of the 10,000 employees of the company are eligible to participate in the plan.

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Protest REA Loan to Virginia Utility

Protests to John N. Carmody, Rural Electrification Administration Administrator, were made last week by spokesmen for groups of citizens from four Virginia counties against a proposed $125,000 loan to the Tidewater Electric Service Company. The allotment has been approved, but the actual loan contract has not been negotiated.

The basis of the farmers' protest was that the REA had discriminated against a newly-formed co-operative which, they claim, will serve more territory at lower cost. The utility project, they claim, will leave unserved nearly three-fourths of the area.

•

Light Tests Offered Gratis

Customers of the Puget Sound Power & Light Company, wishing to have their home-lighting systems tested scientifically and to be shown just how adequate lighting for any room can be accomplished, have only to call the company's nearest office and a home-lighting representative will be sent to the home. This representative will be equipped with the new sightmeter, which accurately and scientifically measures light, just as a thermometer registers heat. The services of these young women who are home-lighting representatives are without cost to customers.

Federal Action Seen in Coast Power Vote

Failure of San Franciscans to submit to New Deal economics by defeating the special revenue bond issue to purchase facilities of the Pacific Gas & Electric Company has brought dictatorial threat from Harold L. Ickes, Secretary of the Interior. In his ultimatum to the Board of Supervisors he is quoted as being prepared to take "appropriate action against San Francisco for violation of the Raker Act" unless he could be assured that the so-called violation of the act would cease at once.

At the present time the city obtains revenue of over $2,000,000 a year from the sale of power generated at the Hetch Hetchy plant. According to the Secretary of the Interior, this sale of power is in violation of the Raker Act and the "appropriate action" threat by Washington authorities might be an attempt to impound or cancel the revenue obtained by the city for the sale of power.

It is expected that the Board of Supervisors will recommend resubmission of the proposal to the voters of the city at the earliest possible date, a process which would cost the city another $50,000 and which could not be completed for at least 40 days, the time required to advertise an election. Civic leaders of San Francisco express themselves as believing that the resentment aroused by the high-handed methods of the Department of the Interior would result in even a more decisive defeat of the proposal than was given at the March 9 election.

•

Rural Lines to Cost $500,000

Announcement has been made by J. P. Pulliam, president of the Wisconsin Public Service Corporation, that approximately $500,000 will be spent in 1937 to extend the utility's rural lines. It is estimated that about 1,500 new rural customers will be added during the year.

•

Texas Hydro Unit Reopened

The hydro-electric plant of the Central Power & Light Company, at Eagle Pass, Tex., which has been closed for nearly five years, due to damage to the watergates of the canal of the Maverick County Irrigation District, was recently again placed in operation. The canal, which supplies the water from the Rio Grande for the plant, has been reconstructed in such a manner as to prevent a recurrence of the flood of 1932, which caused the damage. The irrigation canal of the district is now being extended 56 miles.

•

Steam Station Begun by Consumers Power

The Consumers Power Company will proceed with the construction of a new 98,000-hp steam-electric generating plant at Essexville on Saginaw Bay, according to Dan E. Karn, vice-president and general manager. The plant will create a generating center comparable with any of the company's steam plants in Michigan.

Mr. Karn stated that the project will include the generating plant, coal dock and equipment, substation and 140,000-volt transmission line to the Zilwaukee steam plant and to Flint, together with the necessary substation connections to the latter point. It is expected that the first unit will be in operation June 1, 1938.

The new plant will be named in honor of John C. Weadock, present counsel, with Justin R. Whiting, for Commonwealth & Southern Corporation.

•

Hydro Rates Are Surveyed

A province-wide survey of domestic Hydro service charges is being conducted by the Hydro-Electric Power Commission of Ontario, it was announced last week. Various public utilities in towns throughout the province have applied to the Hydro commission for a reduction in the domestic rate, and in reply the commission has stated that a survey of the question is underway.

•

To Install New Boiler

Additional capacity for station "L" of Portland General Electric Company, Portland Ore., is to be provided by installation in May of a new Babcock & Wilcox type "F" integral furnace boiler with a capacity of 225,000 lb. per hour at 425 lb. pressure. This boiler will bring the station up to its full machine capacity of 75,500 kw. for steady running with a possible peaking capacity of 80,000 kw. The boiler is for oil burning only.

Consolidated Edison Workers Join C.I.O.

The Committee for Industrial Organization entered the public utility industry this past week when the union of Consolidated Edison Company of New York employees deserted the American Federation of Labor and enlisted under the C.I.O.

The membership of Utility Workers Local B752 of the International Brotherhood of Electrical Workers engaged in organizing the 40,000 workers of Consolidated Edison, voted to renounce the A. F. of L. and to bind themselves with the C.I.O. through the United Electrical & Radio Workers.

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Westinghouse Wage Rise

Westinghouse Electric & Manufacturing Company has increased wages of approximately 10,000 employees at the East Pittsburgh, Trafford City and Linhart plants. The increase goes into effect immediately. Wages of men were raised 8 cents an hour and women 6 cents an hour. Men workers are guaranteed 63 cents an hour, women 44 cents an hour and salary adjustments for white collar workers.

•

Plant Nears Completion

The hydro-electric plant of the Red Bluff Power Control District at Red Bluff Dam on the Pecos River will be completed about April 1, according to Vernon L. Sullivan, district engineer for the project. The plant will have a capacity of 5,600 hp. More than $250,000 left from the original government allocation of $2,884,000 for the dam and hydro-electric plant has been set aside for rural electrification program in the valley served by the dam, according to Mr. Sullivan.

•

Puerto Rico Accepts Two Hydro-Electric Projects

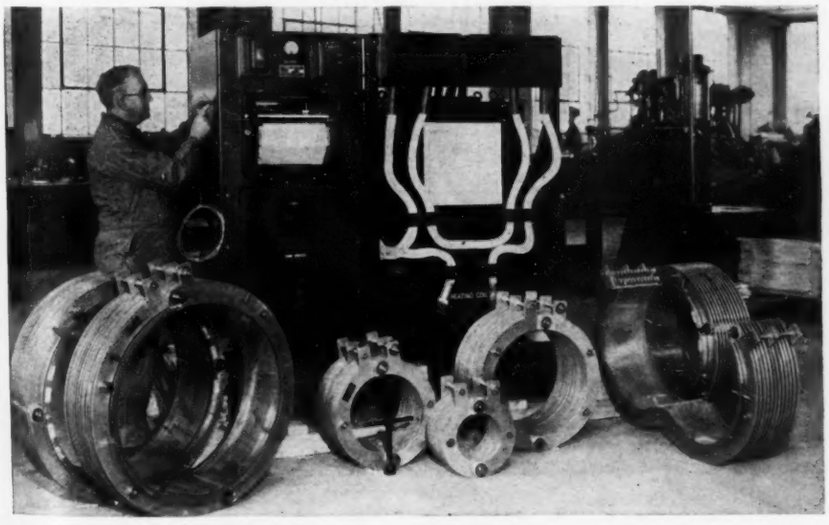
Gov. Blanton Winship accepted this week for the people of Puerto Rico two hydro-electric plants with a generating capacity of 9,000 hp. from the Puerto Rico Reconstruction Administration. They were built as a part of the rehabilitation program of the island. The two plants are located in the mountains near Villalba and use the same stream flow twice.

The plants will electrify that half of the island not served by private utilities. President Roosevelt approved the original rural electrification projects for $2,700,000 from emergency relief funds.

•

Rochester Gas & Electric

The Rochester Gas & Electric Corporation has ordered from the General Electric Company a new 25,000-kw. turbine to cost $600,000. The utility plans a 20 per cent increase in electric output by July 1, 1938, and expenditures in the electrical generating department call for the outlay of approximately $2,250,000.



RELIEVING METALLURGICAL STRESSES—The largest inductive electric stress reliever for welded pipe joints is here shown in the shop of the Detroit Electric Furnace Company, maker. It is applicable to pipe from 4 to 24 inches in diameter. It is the second machine for the M. H. Treadwell Company and will be used in construction of a power plant of Consolidated Edison Company of New York

Court Upsets NLRB Texas Utility Case

An injunction granted by the U. S. District Court at El Paso, Texas, declaring the National Labor Relations Act unconstitutional was nullified last week by the U. S. Circuit Court of Appeals, sitting at New Orleans, in a case originally brought by the El Paso Electric Company.

The higher court held that the point at issue could have been decided without ruling on the constitutionality of the law, and that the lower court had gone too far in issuing an injunction.

The case arose when a regional officer of the NLRB charged the power company with unfair labor practices affecting interstate commerce.

•

First Original Cost Study Filed by Wisconsin Power

Announcement has been made by the Federal Power Commission that the Wisconsin Power & Light Company had filed a study of the original cost of its electric property, pursuant to Electric Plant Instruction 2 of the commission's Uniform System of Accounts.

The Wisconsin Power & Light is the first company to file such a study, which, under the provisions of the accounting system, must be filed by all public utilities subject to the jurisdiction of the commission within two years from January 1, 1937.

The amount of electric plant as of January 1, 1937, is given as $49,154,908.11.

•

New York Merger Set Back by Appeals Court Ruling

Efforts of the Consolidated Edison Company of New York to effect complete unification of the utility's system into a single corporate unit suffered a setback when the New York Court of Appeals unanimously affirmed the decision of the Appellate Division, Second Division, of the New York Supreme Court holding that the calling of New York & Queens Electric Light & Power Company non-callable preferred stock is unauthorized by law. Consolidated had New York & Queens reclassify its $5 non-callable preferred as callable at 105. Minority stockholders contested this stock reclassification.

A.S.M.E. Plans Meet in Detroit in May

The semi-annual meeting of the American Society of Mechanical Engineers will be held May 17–21 at Detroit. An interesting program has been prepared to include discussions by leaders in many industries.

Among those to address the convention are C. F. Hirshfeld, chief of research of Detroit Edison Company; Tracy V. Buckwalter and O. J. Horger, Timken Roller Bearing Company; William S. Knudsen, executive vice-president General Motors Corporation; Fred W. Cedarleaf, Excello Aircraft & Tool Company; Edward G. Budd, president Edward G. Budd Manufacturing Company; Dr. Rupen Eksergian, W. J. Cameron, Ford Motor Company; T. F. Olt, supervising metallurgical engineer of American Rolling Mills Company; Col. Willard T. Chevalier of McGraw-Hill Publishing Company, and leading experts from utilities and other industries.

Alex Dow, president Detroit Edison Company and past-president of A.S.M.E., will be presented with an honorary membership.

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Safety Council Meet Slated for New York

The eighth annual convention of the Greater New York Safety Council will be held April 13–15 at the Hotel Astor. An elaborate program has been prepared, including discussions of highway lighting by Kirk Reid, illuminating engineer of General Electric Company. Edwin H. Land, president of Land Wheelwright Laboratories, Boston, will discuss polarized light.

Wesley M. Graff, director safety education division, National Bureau Casualty & Surety Underwriters, New York City, will discuss impact test of safety belts. Dr. M. F. Skinker, assistant director of research, Brooklyn Edison Company, will discuss design and care of safety belts. Safety belts for construction and maintenance will be discussed by Dan L. Hartnett, senior engineer Travelers Insurance Co.

•

Form New Contractors Group

The Association of Electrical Contractors of North Carolina was recently organized and the old Carolinas Association of Electrical Contractors disbanded. One hundred electrical contractors attended the meeting. Officers chosen for the new association include: Frank E. Hartis of Durham, president; M. B. Haynes, Raymond Starr, J. G. Hammond, J. C. Hobbs, vice-presidents; C. S. Boger, executive secretary, and R. H. Bouligny, treasurer.

•

Chicago Power Show

The Chicago Exposition of Power and Mechanical Engineering announces that a new power show for the mid-West will be held October 4–9, in Chicago. It was said that the new exposition is not intended to supplant the National Power Show at New York. The next New York show will be held December 5–10, 1938.

Meetings

Edison Electric Institute—Annual sales conference and sales committees meetings, Edgewater Beach Hotel, Chicago, Ill., March 29-April 1; technical committees, Chicago, May 3-7; annual meeting, Chicago, June 1-4. Bernard F. Weadock, managing director, 420 Lexington Avenue, New York, N. Y.

Greater New York Safety Council—Annual convention, Astor Hotel, New York, N. Y., April 13-15. Paul W. Garrett, secretary, 60 East 42d St., New York, N. Y.

International Association for Testing Materials—International congress, London, England, April 19-24. K. Headlam-Morley, honorary secretary, 28 Victoria St., London, S.W.1.

Missouri Association of Public Utilities—Annual convention, Elms Hotel, Excelsior Springs, Mo., April 21-23. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

Association of Iron and Steel Engineers—Spring meeting, Buffalo, N. Y., April 28-29. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Electrochemical Society—Spring meeting, Benjamin Franklin Hotel, Philadelphia, Pa., April 28-May 1. Colin G. Fink, secretary, Columbia University, New York, N. Y.

American Institute of Electrical Engineers—Northeastern district, Buffalo, N. Y., May 5-7. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

National Electrical Manufacturers Association—Spring meeting, The Homestead, Hot Springs, Va., May 16-20. W. J. Donald, managing director, 155 East 44th Street, New York, N. Y.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 23-27. Alfred Byers, secretary, National Electrical Wholesalers Association, 165 Broadway, New York, N. Y.

Southeastern Electric Exchange—Fourth annual conference, The Homestead, Hot Springs, Va., May 27-29. J. W. Talley, executive secretary, 308 Haas-Howell Building, Atlanta, Ga.

Rocky Mountain Body Opens Sales Program

As a result of action taken recently in Denver the Rocky Mountain Electrical Association, covering Colorado, New Mexico and Wyoming and parts of South Dakota and Nebraska, and the Electrical League of Colorado will be consolidated on April 1. The new organization will be known as the Rocky Mountain Electrical League. Guy W. Faller becomes president of the new body and Gaylord B. Buck will be chairman of the sales and promotional section.

A greatly expanded sales promotion campaign and provision for stepping up every other activity affecting industry in the intermountain territory, including engineering, operating and accounting, are incorporated in the fourteen-point program of the league. Every outlet for electrical appliances in the Rocky Mountain region is expected to benefit through the broad promotional program. Radio, newspaper and other advertising is projected to increase business.

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Eleventh Steinmetz Lecture

Dr. Harold G. Moulton, president of the Brookings Institution of Washington, D. C., will deliver the eleventh Steinmetz Memorial Lecture at the Mount Pleasant High School, Schenectady, Tuesday evening, April 6. His subject will be "Engineering Progress and Economic Progress." Dr. Moulton, who is the author of many books on money, banking and war debts, is recognized as an outstanding leader in economics.

•

Chemical Industry Meet

The Society of Chemical Industry, American section, will hold a meeting on April 9 at 7:45 p.m. at the Chemists' Club, New York City. Prof. James E. Kendall, head of the chemistry department of the University of Edinburgh, will be the speaker.

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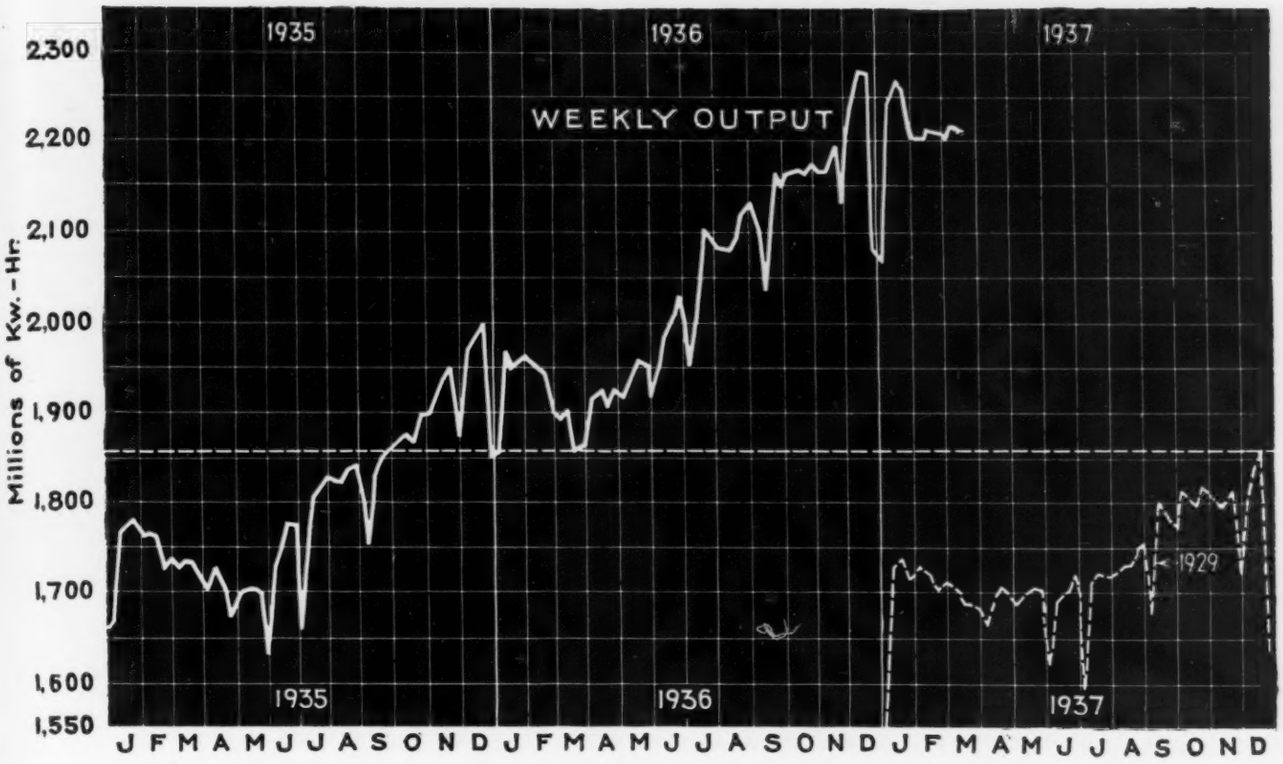
Wage Increase in Bridgeport

Wage increases adding approximately $158,000 to the annual payroll of the General Electric Company plant at Bridgeport, Conn., have been given to 1,800 hourly paid employees, W. Stewart Clark, works manager, has announced.

Output 16.3 per Cent Over Last Year



Energy production indicates a continuation of the vigorous rise in industrial activity noted in recent weeks in all parts of the country except the Pacific states. For the week ended March 20 it amounted to 2,211,052,000 kw.-hr., according to the Edison Electric Institute, exceeding last year's production for the corresponding period by 16.3 per cent. Thus the gain was nearly up to the 16.9 per cent of the preceding week and surpassed the 15.6 per cent of two weeks ago. The curve is still resisting the normal downward trend that accompanies lengthening daylight.

In the Rocky Mountain region the gain over 1936 has climbed to 30.7 per cent, an unusual figure that is no doubt closely related to the rising demand for copper. The Central industrial region, at 20.0 per cent, is well above the average for February. The South, still climbing, is up to 19 and New England to 21.1 per cent.

Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
Mar. 20..2,211	Mar. 14..1,901	Mar. 16..1,728
Mar. 13..2,213	Mar. 7..1,893	Mar. 9..1,724
Mar. 6...2,200	Feb. 29..1,903	Mar. 2..1,734
Feb. 27...2,207	Feb. 22..1,942	Feb. 23..1,728
Feb. 20...2,212	Feb. 15..1,950	Feb. 16..1,761
Feb. 13...2,200	Feb. 8..1,952	Feb. 9..1,764

Per Cent Change from Previous Year

Region	Week ended Mar. 20	Mar. 13	Mar. 6
New England.....	+21.1	+15.8	+14.2
Middle Atlantic....	+14.5	+13 9	+12.3
Central Industrial.	+20 0	+21.3	+21.0
West Central.....	+ 9 9	+ 8 8	+ 9.5
Southern States...	+19 0	+18.1	+17.7
Rocky Mountain..	+30.7	+28.2	+23.5
Pacific.....	+ 4.2	+ 5.4	+ 7.2
United States...	+16.3	+16.9	+15.6

British Grid Shows Power Output Gain

The British Central Electricity Board reports electrical output of over 20,000,000,000 kw.-hr. for 1936, according to a radiogram from Paul Wooton, Washington correspondent of ELECTRICAL WORLD who is now in London before attending the Leipzig Fair.

This represented an increase of 15 per cent over the preceding year. Grid economics claimed 14 per cent reduction in the cost of fuel over 1932, despite increased coal costs. The capital savings claimed is £14,000,000 for the 155 generating stations under the board's jurisdiction. It was reported that sixteen of the lowest cost stations produced 50 per cent of the total savings. Only 26 stations operated full time.

The grid now comprises 4,126 miles of line and furnishes 95 per cent of the area. The energy increase was nearly all domestic. An increase of 10 per cent is predicted for this year, water heaters to comprise the principal item.

•

Utility Market Study

Third in the series of studies of the basic industrial markets in the United States by the Bureau of Foreign and Domestic Commerce presents the gas and electric utilities of the country as a potential market for industrial equipment and supplies.

•

Indiana Highway Lighting

The Indiana State Highway Commission announces that a section of the Dunes relief highway will be illuminated within the next two months. The project is being sponsored with the co-operation of the Northern Indiana Public Service Company. The lights to be used are to be the new type sodium-vapor, 100,000-lumen intensity. Spacing will be 240 feet.

Utility Stocks Drift Lower

Continued decline in utility stocks sent prices to a new low for the year. Investor confidence appears lacking because of uncertainty over the solution of the Federal power program. "Electrical World" index, 36.2; last week, 36.7; 1937 high, 41.5

Standard Gas Unit Postpones Dividends

Louisville Gas & Electric Company has informed stockholders that, owing to the fact that it still was impossible to determine accurately the amount of damage sustained by the company during the recent flood, it had postponed action on the common stock dividends for the quarter ended February 28.

The company also stated that no action was taken on dividends on its class A and class B common stocks at this time.

It was stated by the company in its letter that "we greatly regret the circumstances which have made this action necessary, but in view of existing conditions are confident we have acted in the best interest of all concerned."

•

Form Protective Committee

Formation of a protective committee for the holders of common stock of Utilities Power & Light Corporation, in reorganization under section 77b, has been announced. Hamilton Pell, a partner of Pell & Company, is chairman. Federal Judge William H. Holly recently ordered the present management of the corporation continued and appointed James L. Houghteling, investment banker, as a special investigator to examine operations of the company. Harley L. Clarke, former president, who is involved in suits and counter suits with Floyd B. Odlum, president of the Atlas Corporation, had filed objections to continuance of the present management.

•

California Utilities to Merge

The Los Angeles Gas & Electric Company and the Southern California Gas Company have filed with the California Railroad Commission an application for authority to merge the two companies into the Southern California Gas Company.

•

Seeks Approval of Merger

The Federal Power Commission has ordered a h aring held on April 2 on an application by the Citizens Power & Light Company, Council Bluffs, Iowa, and the Nebraska Power Company, Omaha, Neb., for approval of the sale and disposition of the whole of the facilities of the Citizens company to the Nebraska company, resulting in the consolidation of such facilities with those of the Nebraska company. Both companies are subsidiaries of the American Power & Light Company, an Electric Bond & Share affiliate. The Nebraska Railway Commission has already approved the consolidation.

•

S.E.C. to Hear Utility Plea

A hearing for April 8 has been called by the S.E.C. on an application by the Illinois Power & Light Corporation, a subsidiary of the North American Company, for an order authorizing it to charge against paid-in surplus resulting from a proposed reduction of capitalization any and all cash payments on certain dividend-arrears certificates proposed to be issued and a dividend of $20,000, or 50 cents a share, which it proposes to pay on its 6 per cent cumulative preferred stock.

•

General Cable Votes $12,000,000 Issue

Stockholders of the General Cable Corporation at the annual meeting held last week approved the issuance of approximately $12,000,000 of new first mortgage bonds and the retirement of $11,477,000 of 5½ per cent series A and B first mortgage bonds.

D. R. G. Palmer, president of the company, said business for January and February was substantially ahead of a year before, and that while it is difficult to see clearly more than 30 days ahead, the company was looking for continued improvement this year if the public utilities and other large consumers of copper wire and cable bought the quantities expected of them.

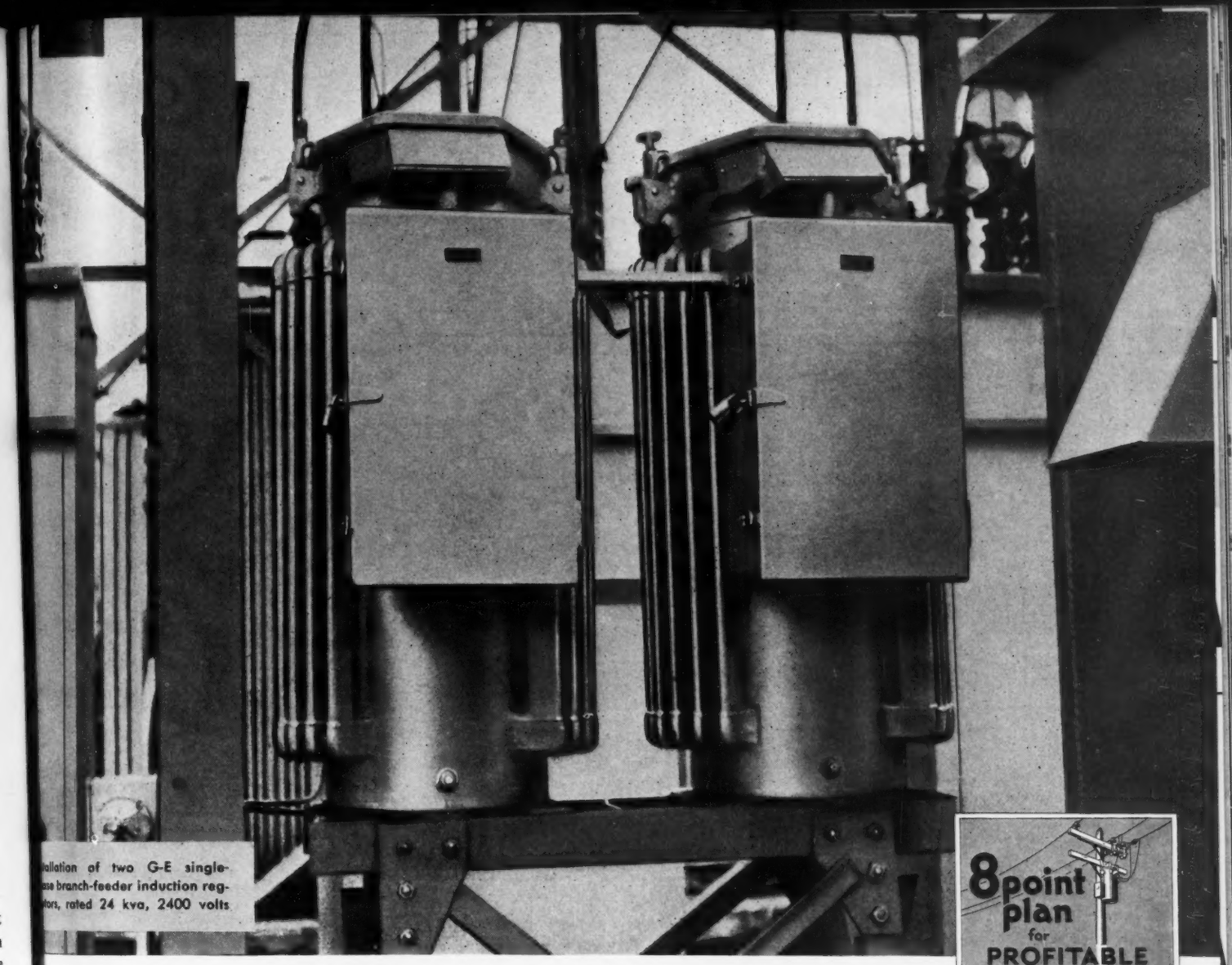
The open winter, as well as the emergency demand, was largely responsible for the great improvement in the company's business thus far in 1937, Mr. Palmer said. "Absolute necessity is bringing in more and more utility buying," he added.

It is expected that a registration statement for the new bond issue will be ready for filing with S.E.C. within a month.

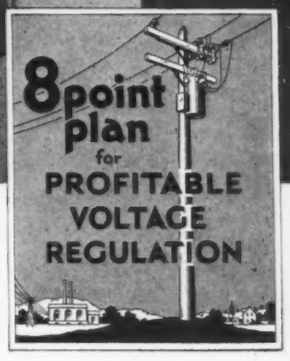
Earnings Statements
(Utilities)

	1936	1935
Central Power*	$109,041	$76,200
East Missouri Pwr.*...	42,371	18,491
Boston Edison*.....	5,170,907	5,045,787
Great Lakes Pwr.*....	217,187	131,065
Kans. City Pwr. & Lt.*	4,710,405	3,627,868
Lexington Utilities*...	321,286	353,331
Michigan Gas & Elec.*	80,111	52,695
Michigan Pub. Serv.*..	51,617	73,962
Missouri Edison*.....	30,697	16,344
Philadelphia Elec.*....	21,918,986	22,039,953
Illinois Pwr. & Lt.*....	2,618,961	2,231,124
North Amer. Lt. & Pwr.*	4,520,568	3,883,493
	1937	**1936**
Detroit Edison 12 mos., Feb. 28.....	$10,705,248	$10,227,138
Kansas City Pwr. & Lt. 12 mos., Jan. 31.....	4,696,772	3,706,163
Public Service of N. J. & Subs. 12 mos., Feb. 28.....	24,910,933	23,267,609
Puget Sound Pwr. & Lt. 12 mos. to Jan. 31...	1,714,838	1,157,202

* Annual report.



allation of two G-E single-
se branch-feeder induction reg-
tors, rated 24 kva, 2400 volts



Improved Service Came First,

BUT A $924 SAVING WAS WELCOME

A desire to improve customer's service was the principal reason for the installation of these G-E branch-feeder induction regulators by a New England utility. But when it was found that this method of regulation would save $924 in capital investment over other methods of maintaining correct voltage levels, the news was welcome. Station-type regulators might have been used for this application, but branch-feeder induction regulators were available to meet the voltage and current requirements at a cost of almost $1000 less. They also saved considerable installation space, which was at a premium. Excellent service is now being provided and desired voltage levels are being maintained.

The complete line of G-E regulating equipment makes it possible to regulate for all areas and all load densities in the most economical manner. Perhaps there are circuits on your systems that can now be regulated at a profit to both your customers and yourself by the use of one of the many G-E regulators. We shall be glad to discuss regulator application with you. Have you a copy of our portfolio, "The 8 Point Plan for Profitable Voltage Regulation" (GES-1142A)? General Electric, Schenectady, N.Y.

350-133

GENERAL ELECTRIC

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Suggests Anchors for Rural Line Grounds

By A. G. CARSON
Chief Engineer,
Wisconsin Public Service Corporation*

In order to discover the effectiveness of anchors when used for grounding, some tests were carried on in Brown County, Wisconsin, during October, 1936. Results of these tests appear in the accompanying table. They seem to indicate that anchors and their rods have considerably more ground resistance than conventional type rods. Due to the small number of tests these results are not conclusive, and it is believed desirable to continue to consider the use of guys and anchors for grounding purposes, either to supplement or replace conventional type grounds. The anchors tested were all cone type, while the ground rods were 8-ft. x 5/8-in. non-ferrous rods. The anchor rods were 8 ft. long.

There were not enough tests made to justify definite conclusions and the test results must be taken for the value they have by themselves. If the guys and anchors on a rural line could be used to supplement the regular ground a lower ground resistance could probably be secured on a multiple-ground neutral system, or if the guys and anchors could be used in place of some of the conventional grounds required, then a reduction in construction costs could be secured.

At the end of a delta-connected rural line where the line is now dead-ended with a guy and anchor at the transformer setting a saving could be made if the guy and anchor could be used for the secondary neutral ground at the transformer. In some present methods of construction the arrester ground is placed on the last pole of the line with the transformer setting and it is necessary to carry the secondary neutral ground back along the line one span, thus the last span must be short. This causes increased cost besides introducing considerable impedance in the neutral ground due to the extra span of wire.

Comparison of the Ground Resistance of Anchors and Their Rods With Adjacent Ground Rods

Tests made in Brown County, Wisconsin, October, 1936)

Ground Resistance (Ohms)			
Anchor and Rod	Ground Rod	No. of Ground Rods	Nature of Soil
A. Tests on new (1936) construction:			
30	9	2	Sand and clay
120	90	2	Sand and clay
50	9	2	Clay
90	12	2	Clay
50	9	2	Clay
30	4	2	Clay
70	24	2	Sand and clay
B. Tests on old construction:			
130	70	2	Clay
60	16	1	Clay
50	18	1	Clay
90	20	1	Clay
59	19	1	Clay
16	12	2	Clay
90	16	1	Clay
70	12	1	Clay

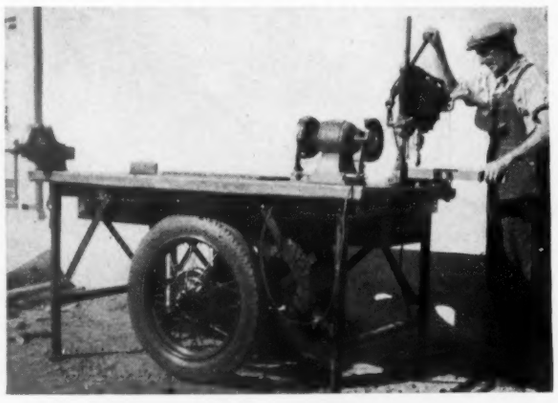
*From paper to Wisconsin Utilities Association.

Portable Workbench Speeds Maintenance

By CARL W. SMITH
Pacific Gas & Electric Company,
San Francisco

Major outdoor high-voltage substations cover considerable acreage. Maintenance of switching equipment is necessary at least once a year. A great deal of time may be saved by having tools near at hand. The accompanying illustration portrays a portable workbench that has been designed and built for this purpose.

A steel tool drawer mounted on



Top frame is made of angle iron and covered with 1¼-in. lumber covered with black sheet iron. Size of top is 3 x 5 ft. Legs are of 1¼ in. pipe with flanges for footings and slotted at the top to fit over the web of the angle iron. At this point bolts pass through to form hinges, allowing the legs to be drawn up to clear the ground. Pipe braces are welded between the legs on the end of the bench and angle braces on the sides. These side braces may be unhooked from their brace position and moved to a pin in the angle iron frame directly above center of wheels. These then become carriers for the legs, while the weight is on the wheels. Wheels were salvaged from automobiles. To prevent the bench from tipping at either end while being moved a shoe is welded in the center of the axle on one side, while a castor of 6 in. diameter is mounted on the other side. This shoe and castor clear the ground, about 3 in. A tongue is fastened to the castor so that the workman can pull the bench around from one switch to another without difficulty.

Tool table rolls to switch maintenance job

105%

MORE LIGHT on the Street . . . .

By Low-cost Modernization

YOU can now modernize your street-lighting equipment without expensive changes in wiring, pole construction, brackets, insulators.

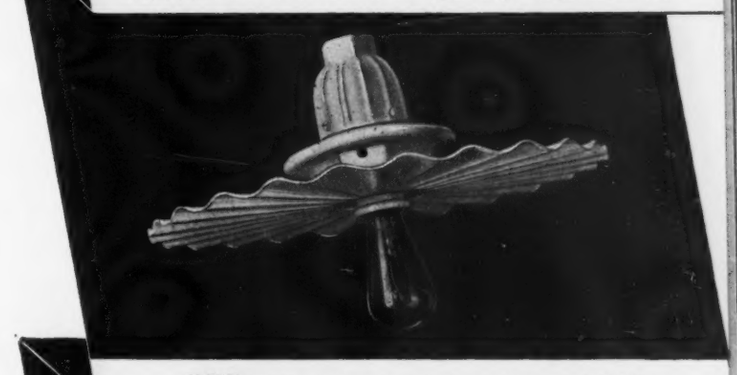
Modernization of old Form 6 luminaires is accomplished simply by replacing the casings and globes of the old units with those of the new units embodying a spun-on, one-piece refractor. The result—105 per cent more light on the street and reduced costs due to reduced glassware breakage.

Flat radial-wave reflectors may be modernized by replacing them with the new, nonchipping, nonrusting Alzak aluminum shading radial-wave reflectors installed on the original insulators. The result—35 per cent more light on the street.

Thus modernization with General Electric equipment greatly increases the amount of light on the street and improves the appearance of your system at very low cost. In addition to these advantages, the new luminaires shield homes from objectionable glare, require less maintenance, give more uniform light distribution and longer life. For additional information, send the coupon to General Electric Company, Schenectady, N. Y.

OLD Form 6 luminaire with globe

NEW Form 6R luminaire with spun-on, one-piece refractor



OLD Flat radial-wave reflector with enamel finish

NEW Alzak aluminum radial-wave shading reflector

GENERAL ELECTRIC

General Electric Company
Schenectady, New York

☐ *Please send additional information on the new Form 6R luminaire*

☐ *Please send additional information on the new shading radial-wave reflector*

Name.....

Street.....

Position.....

City.....

500-216

Treated Pole Tests Made at Nashua

Test No.	1	2	3	4	5*	6	7
Wood in pole	No. Pine	So. Yel. P.	Nor. Pine	So. Yel. P.	So. Yel. P.	Nor. Pine	Nor. Pine
Length (feet)	35	35	35	35	35	30	30
Class	4	4	6	6	4	5	4
Circumference (Inches)							
Top	26	24¾	23⅝	21¼	26⅞	25¼	28
Center	32	30	28⅜	26¼	31⅛	29	32¼
6 ft. from butt	36½	32	31¼	29	33¾	32	34¼
Butt	42	39½	39	32¾	38¼	35¼	39
Diameter (inches) at 6 ft. from butt	11.6	10.2	9.95	9.23	10.7	10.2	10.9
Top of pole to ground (feet–inches)	29–6	29–2	29–2	20–6	29–5	25–3	25–0
Effective bending moment (in.–lb.)	808,500	880,200	619,400	759,000	1,233,750	753,300	828,000
Ultimate fiber stress (lb.–sq. in.)	5,275	8,446	6,403	9,830	10,256	7,229	6,511
Load (lb.) Deflection (in.)	700–14.6	400– 4.9	200– 7.3	900– 0.0	600– 10.4	900– 13.9	900– 12.6
	1,000–24.3	925– 22.7	800– 23.0	1,300– 22.0	1,250– 21.4	1,400– 23.0	1,650– 25.4
	1,500–41.9	1,250– 29.8	1,300– 49.0	1,800– 40.2	2,000– 39.5	1,700– 37.7	2,000– 38.4
	2,000–78.0	1,550– 41.9	1,600– 77.6	2,100– 67.8	2,550– 59.0	2,100– 57.0	2,200– 44.8
	2,450–94.8	1,800– 64.0	1,900–114.1	2,300– 91.0	3,000– 79.3	2,500– 77.6	2,500– 58.0
		2,200– 87.5	–117.4	–114.5	3,300– 93.4	2,700–112.4	2,800– 82.2
		2,600–119.8			3,600–115.9		3,000–105.0
		2,700–130.7			3,750–139.0		
					–150.2		

* Spiral grain in pole.

The characteristics of the breaks were as follows:

Test No.
1 Pole broke near ground line, but splintered upward 30 in.
2 Pole broke fairly cleanly at ground line.
3 Pole broke cleanly at ground line.
4 Splintering break about 18 in. above ground.
5 Clean break about 5 in. below ground line.
6 Clean break at ground line.
7 Clean break at ground line.

Note:— The deflections on tests Nos. 3, 4 and 5, against which no load is recorded, indicate that the maximum load is the load recorded just before, and this deflection is the point at which the pole cracked just before it fell to the ground. On test No. 4 the deflection caused by the first 900 lb. pull was not recorded. The balance of the deflections on this pole should be corrected by an estimated 17 in. based on test No. 1.

rollers is installed at each end of the bench. A swivel base combination bench and pipe vise is mounted on one corner, a portable electric drill on another and an emery wheel on the third corner.

The bench is wired in Bx conduit with outlets at the four corners. Power, taken from a yard light post and connected to one of the outlets by Tirex cord, energizes all of the outlets. Extension lights as well as the power tools may then be connected at one of the outlets.

Two holes through the top of the bench above the axle accommodate the small size oxygen and acetylene tanks which are supported on a shelf built across the axle. The weight of these tanks is balanced by this construction so that very little exertion is needed to haul the unit.

An oil-treated canvas supported by ½-in. pipes forms a complete shelter for the equipment and a shady working area for the men. The workmen at the stations in which this equipment is being used claim it to be very desirable and it has paid for itself over and over again.

•

Modern Truck Aids Fixture Maintenance

In keeping good the tradition of installing only the finest of equipment on the San Francisco-Oakland Bay Bridge, the California Toll Bridge Authority has purchased a specially designed truck to simplify maintenance of the 922 sodium-vapor lighting units installed on the bridge and approaches. The truck mounts a telescopic trusswork operated by the motor. Atop it is the working platform.

The platform can be rotated through a 180-deg. arc and a double floor permits extending its working area several feet beyond the edge of the roadway. The double sodium-vapor luminaires shown in the illustration swing outward and reveal the interior wiring connections for easy maintenance and repair. Space is provided on the truck platform for transporting the necessary equipment for maintenance and repairing the luminaires.

Special service truck simplifies luminaire maintenance

For maintaining the sodium-vapor luminaires on the San Francisco-Oakland Bay Bridge. The platform is shown in a rotated position and extended to reach the standard.

Pole Breakage Tests at Nashua Plant

Comprehensive tests of seven pine poles to the breaking point when keyed in the ground were recently conducted for the benefit of the Electric Lines Club of New England at the Nashua plant of the Wood Preserving Corporation. The poles used in the demonstration were selected and set by the Public Service Company of New Hampshire alongside a railroad track, and the necessary pull was exerted by a railroad crane through a wire rope 200 ft. long attached to the pole 2 ft. below the top. The strain was applied by increments and the deflection measured by a transit. The tests are as shown in the table above.

•

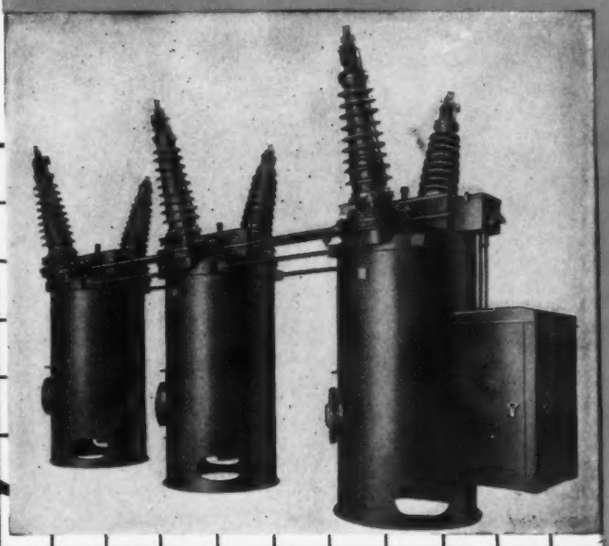
For Cleaning Meter Jewels

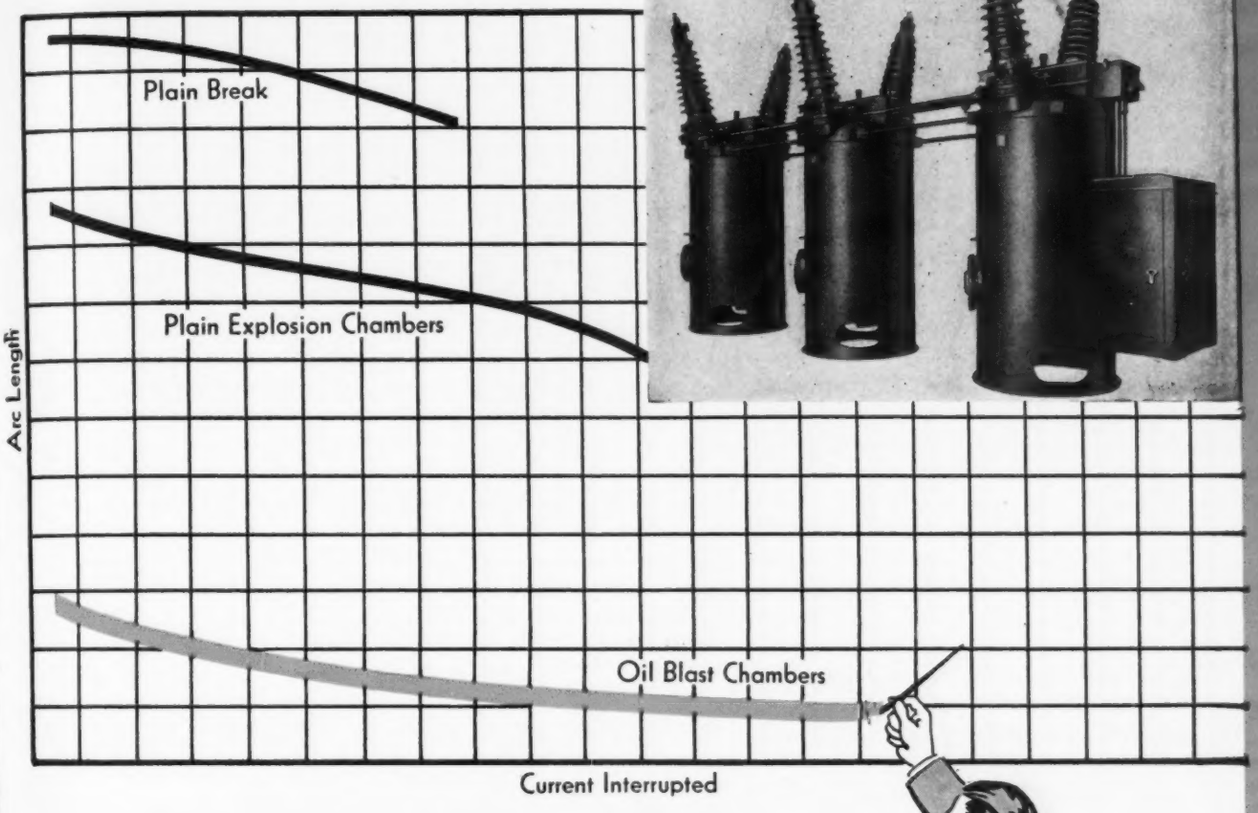
Right above the two panels of the board where the smaller size meters are tested in the meter shop of the Public Service Company of Oklahoma at Tulsa there has been placed a small panel on which a sewing machine motor is mounted. To the end of the motor shaft is attached a pointed piece of soft wood, a sort of spindle, on which a bit of long fiber surgical cotton is wound by the rotation of the motor. The cotton is dampened with jewel oil and the lint-covered end of the spinning spindle is used for cleaning meter jewels.

The meter tester removes a jewel

Arcs Cost MONEY—

OIL-BLAST OUTDOOR TYPE K-339 BREAKERS





-so we put the curve down here

WHEN a breaker opens, the length of the arc is a measure of the maintenance cost for that breaker. The arc lengths for modern oil-blast breakers are only a small fraction of what they were before the oil-blast principle was introduced. That means less carbonizing of oil, less contact burning, less frequent inspection—all of which means a lot to you in reduced maintenance. Take advantage of these savings by specifying oil-blast breakers.

K-339 types—500,000 to 2,500,000 kva interrupting rating; voltages 15 to 230 kv. All are oil-blast. They're dependable. General Electric Company, Schenectady, New York.

890-20

GENERAL ELECTRIC

from the meter to which he has just given the "as found" test. He explores the surface of the jewel with the point of a needle and, finding no breaks or roughness, decides the bearing is O.K. Before replacing the jewel in the meter he reaches up and cleans it on the rotating spindle. It is important to use long fiber cotton for this cleaning method, so that short fibers will not remain on the jewel. Also, it is necessary that the oiled cotton project a little from the end of the spindle so that the cleaning is actually done by the cotton and not by the wood point.

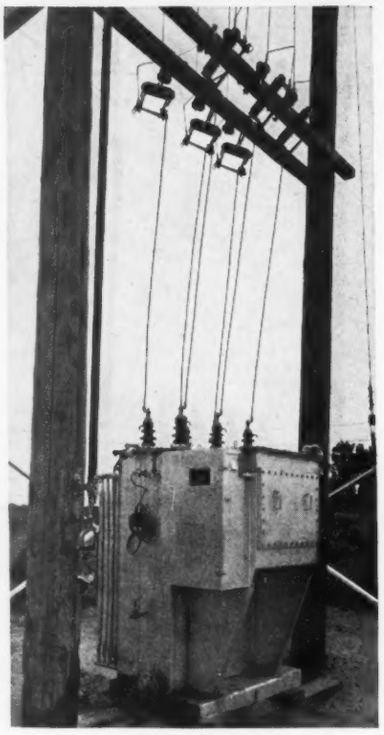
•

Step Regulator Stalls Major Capital Outlay

By H. H. MINOR
San Joaquim Lt. & Power Corp.
Fresno, Calif.

Load growth, particularly in irrigated rural areas, is difficult to predict. On the San Joaquin Light & Power Corporation system a low-voltage condition was encountered midway between two substations. The area is served by a No. 2 feeder 5½ miles long from one of the stations having ample reserve capacity. Load along the 5½-mile route of the first circuit is served by a second feeder, the first dividing into two main branches in the area, one branch being capable of connection, through sectionalizing switches, to the other substation over a long route. The other branch was capable of being connected to this same substation over a much shorter route by building 1 mile of line. Should about 3 miles of small copper be replaced with No. 2, there could be a direct main No. 2 tie-line between the two substations over the shortest route possible.

As the second substation was fully loaded, the logical step would be to transfer some of the load from the second to the first substation. To do this and still provide satisfactory voltage regulation for certain customers in the area required more line capacity than was available or could be made available by the completion of the No. 2 tie line. The line, however, would permit the transfer of 800 kw. of load from the second substation and would be ample from the standpoint of capacity and a consideration of losses. The low-voltage condition still could not be corrected



Step-type voltage regulator installed on a 12-kv. rural tie line conserves capital investment, permits more economical use of system facilities and improves a low-voltage condition

without the expenditure of $40,000 for new copper.

Both substations are equipped for bus regulation, but line drop compensation was not practical because of the different characteristics of feeders served.

As the feeder served no load for the first 5½ miles of its length, and as a raise in voltage is normally required at that point, a step-type regulator with a fixed "boost" and a 7½ per cent raise and lower regulating winding was selected to solve the voltage problem incident to building the new tie. This results in a total of 15 per cent range; 2½ lower and 12½ per cent raise. By means of suitable line drop compensation, it was possible to move the point of constant voltage approximately 3½ miles beyond the regulator or 8½ miles from the substation, the slight overvoltage along the distance between regulator and load center not being objectionable on this service.

Loading on the new feeder, including the 800 kw. transferred from the second substation, will be 1,800 kw. at 85 per cent power factor. The resultant voltage drop to the regulator will be 8.5 per cent. From the regulator the 1,300 kw. to be served over the reconstructed 3-mile section that will complete the tie has a 3.5 per cent drop. At full load therefore the regulator must maintain an outgoing voltage 12 per cent higher than its supply. It was estimated that with the new arrangement the maximum fluctuation between no load and a full load would be 4 per cent, a very satisfactory regulation for rural lines.

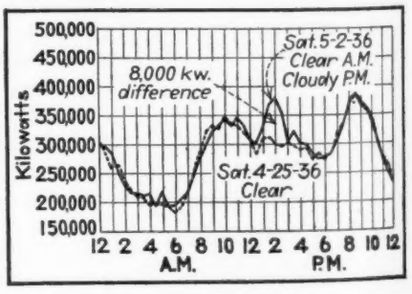
To arrive at the same result using copper would have required four No. 2 circuits or two No. 1/0 circuits costing $40,000 instead of $11,000, the cost of the step regulator installed. To correct the low-voltage condition alone would have required an addition No. 1/0 feeder costing twice as much as the regulator without producing the added advantage of permitting load transfer for better utilization of existing facilities.

•

Daily Load Curve Shows Storm Peak

Graphic evidence of the effect of thunderstorms on system load is given in the accompanying chart, which compares the daily load for consecutive Saturdays on the system of the Detroit Edison Company.

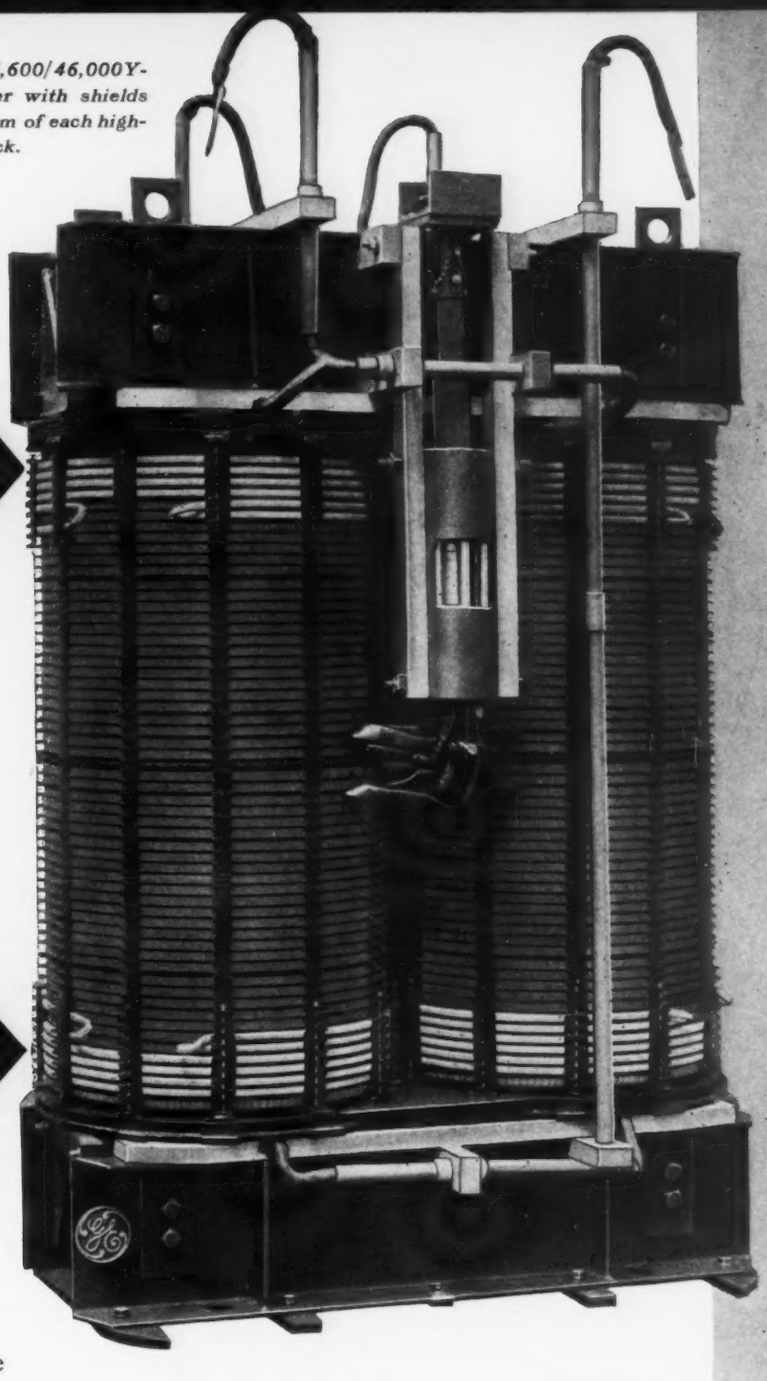
Unlike April 25, which was a comparatively clear day in Detroit, May 2 was cloudy in the afternoon. In fact, it became so dark between 1:25 and 1:40 p.m. that it became necessary to feed 8,000 kw. into the Detroit Edison Company system over the Superior-Blackstone interconnection to meet the peak occasioned as customers turned on their lights. This peak



Load curve mirrors short time peak occasioned by thunderstorm

of 381,200 kw. due to the storm nearly equalled the regular evening peak of 386,700 kw., which occurred at 8:30 p.m.

This ability to absorb peaks at comparatively short notice is one of the many important factors affecting the cost of electric service.



Single-phase 26,600/46,000Y-volt transformer with shields at top and bottom of each high-voltage coil stack.

A Transformer Shield

that is as simple as it is effective

MORE THAN 4,000,000 KVA WITHOUT A FAILURE

YOUR opportunity to save maintenance expense and avoid interruptions to service, in the field of power transformers, is definitely presented by the G-E shielded-winding design. The service record of these remarkable units is one of which we are justly proud, more than 4 million kva having been placed in operation since 1926 *without a failure of a shielded winding.* This construction, which is standard for all G-E power transformers for 44,000 volts and above, has definitely eliminated the greatest source of potential major trouble in a power transformer.

The effectiveness of the G-E shielding principle is matched only by its simplicity. Electrostatic shields, external to the windings, and connected to the line terminals, are so proportioned in each design as to provide the necessary stress distribution.

External application permits the retention of all the desirable features of G-E circular-coil construction, since there is no interference with the structure of the winding itself, or with the major insulation.

Publication GES-1331 describes the G-E shielding principle. We shall be glad to mail you a copy. General Electric Company, Schenectady, New York.

310-19

GENERAL ELECTRIC

Industrial ELECTRIFICATION

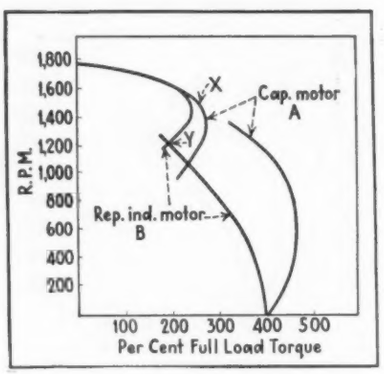
New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Choosing Right Motor for Gasoline Pumps

By E. A. WHITING
Industrial Division, Westinghouse Electric & Manufacturing Company, Philadelphia

Along with many improvements in gasoline pumps designers have found that the capacitor type motor is best suited for trouble-free performance.

The repulsion-start induction-run motor has been used successfully for many years, although requiring some maintenance to keep the commutator, brushes and short circuiter in best condition. At times, due to various reasons, the load increases to the point where the torque required on the pull-up falls in the cusp in the speed-torque curve of the repulsion-induction motor and the motor hangs there, is not able to pull through onto the induction winding and "cooks" unless protected by a thermal overload device, such as the "Thermoguard."



Comparative speed-torque performance of capacitor and repulsion-induction motors for driving gasoline pumps

Such troubles, infrequent though they may be, are yet a real maintenance expense. They can be eliminated by applying a capacitor motor, provided the motor has sufficient starting torque (and such is readily obtainable), because:

1. A capacitor-start induction-run motor has no short circuiter.
2. A capacitor-start induction-run motor has no brushes.
3. A capacitor-start induction-run motor has no commutator.
4. Its armature is squirrel-cage type instead of wound rotor type and, therefore, much lighter in weight; it is easier on bearings; it has less inertia to overcome in "pull-up."
5. It has a speed-torque curve which is *smooth* all the way up to full load speed, since the combined winding part of the curve blends into the induction winding part of curve.
6. The slightly heavier pull-up current effect on voltage is overcome by high accelerating torque characteristics.

A speed-torque curve taken on a standard capacitor-start induction-run explosion-resisting service station gasoline pump motor is shown at "A." Attention is called to the increasing torque on pull-up in contrast to the repulsion-start induction-run motor curve marked "B." After the unit has accelerated to considerable speed, the torque drops off slightly to the point "X," where the combined winding curve is practically tangential to the running winding curve. Compare this performance to that of the repulsion-start induction-run motor, where we find the motor passes through the "cusp" shown at "Y," which is the valley of trouble under certain load conditions.

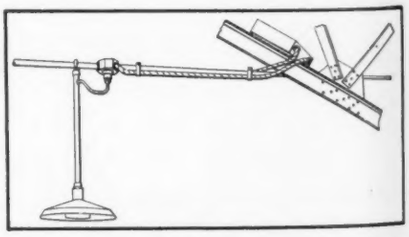
The general run of capacitor motors have more or less complicated connections for changing from 110 volts to 220 volts where dual voltage motors are used. At present dual-voltage motors are needed for service station gasoline pumps. However, gasoline pump capacitor motors are now obtainable with very simple arrangements to accomplish this voltage change. Loosening a screw and moving a little sector 30 deg. reconnects the motor for the other voltage. This does not change the voltage impressed upon the condenser and so no complication arises to cause change in condensers.

•

Simplifies Servicing of Mercury Lamps

By H. E. WATTERSON
Works Engineer, Chrysler Plant, Chrysler Motor Corporation, Detroit, Mich.

When it is necessary to replace or to do other maintenance work on a unit in the new high-pressure mercury-vapor lighting installation in the machine shop of the Jefferson plant of the Chrysler Motor Corporation the machines in the affected area do not have to stop production because the light is off. The electrician just hangs a replacement fixture and plugs it in. This is possible because the fixtures are hung on the circuit conduit and plugged into box receptacles as shown in the accompanying sketch.

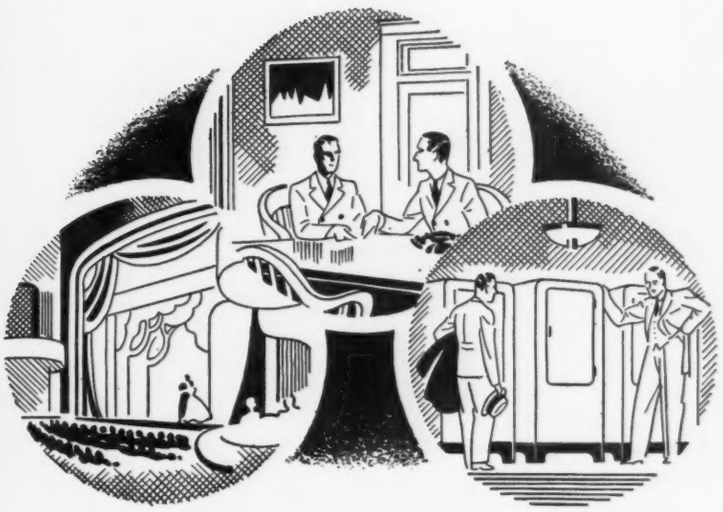


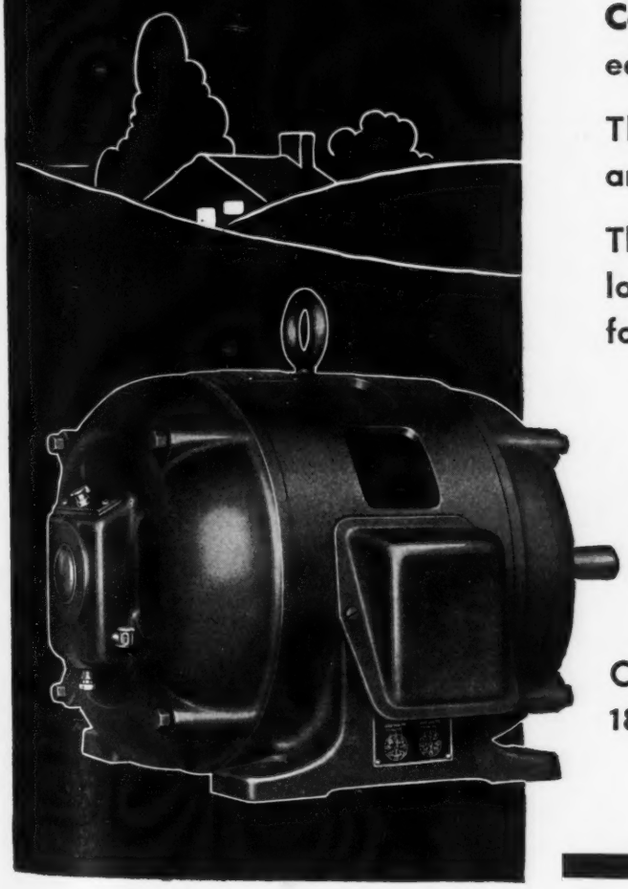
Easy to service this mercury vapor lamp fixture

The stem of the fixture terminates in a hook hung over the circuit conduit. From side knockouts in the outlet box run a pair of two conductor BX leads to and from the lamp transformer mounted on a nearby member of a roof truss. By means of a short flexible lead the fixture is plugged into the receptacle in the bottom of the box. A fixture to be cleaned or to have a new lamp is thus easily replaced by another in operating condition

There are 288 400-cp. units in the installation, hung on 16-ft. centers

"QUIET PLEASE"





Comfortable and Air-Conditioned Quarters allow more concentration on everbody's everyday job... Keep prospects and customers at ease and in a more receptive frame of mind... Reduce annoyance and distractions.

Century Motors are especially adapted to Air-Conditioning, because:

They start quietly—run quietly—and are remarkably free from vibration.

They were ready for Air-Conditioning long before Air-Conditioning was ready for industry.

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MOTORS

CENTURY ELECTRIC COMPANY

1806 Pine Street + + St. Louis, Mo.

Offices and Stock Points in Principal Cities

SIZES UP TO 600 HORSE POWER

lighting an area 80 ft. wide and 900 ft. long. The mounting height is 14 ft. and the illumination is 25 ft.-candles on a working plane 3 ft. high. Each fixture is equipped with a 24-in. shallow dome reflector (Wheeler No. 2556) and the lamp is surrounded by a diffusing ring of frosted glass. Including Mazda lamps for aisle lighting, there are 192 circuits of No. 12 wire in the installation. The mercury vapor lamps are two on a circuit, with adjacent lamps on different circuits, so that a circuit failure will not put out two lamps alongside each other.

•

Electric Kilns Cut Firing Time

By A. J. GIBBS-SMITH
Solihull, Warwickshire, England

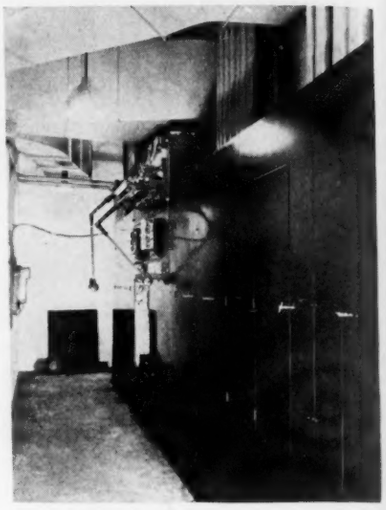
Interesting work has been carried on in Germany comparing the economy of operation of small intermittent Russ-type electric furnaces and typical solid-fuel-fired furnaces for firing high-grade decorated glassware. Economies of 2½ hours in total operating time per charge and closer control of temperature variation are reported for the electric furnaces over the fuel furnaces.

Sections through the Russ-type furnaces made by Industrie Elektroofen G.m.b.H. of Cologne, Germany, are shown in the accompanying illustrations. Effective space of the furnace is heated with 15 kw. in elements arranged on both sides of the chamber, which is 2 ft. wide, 3 ft. 6 in. long and 2 ft. 9 in. high. Total current consumption is about 45 kw.-hr. per charge, which in the case of wine glasses is about 110 lb.

Operation of solid-fuel furnaces, with which these electric furnaces were compared, requires 1¾ hours with the muffle open to attain a temperature of 250 deg. C., at which point the muffle was closed and heating continues under close supervision until, after about 4¾ to 4½ hours, the temperature approaches the critical level. At this point extreme care and attention are required of the operator, who must so control the stoking by constant observation as to insure that an even temperature is obtained in all parts of the heating chamber. When inspection shows that firing is complete the fire is quickly drawn and the muffle and its contents allowed to cool. Some three hours is required for the temperature to drop to 250 deg. C., when the ware is withdrawn. During the heating-up period it is difficult to prevent a difference in temperatures of 8 to 10 deg. C. from occurring in different parts of the furnace. The whole operation of heating up and cooling takes about eight hours, of which five is represented in the heating-up period.

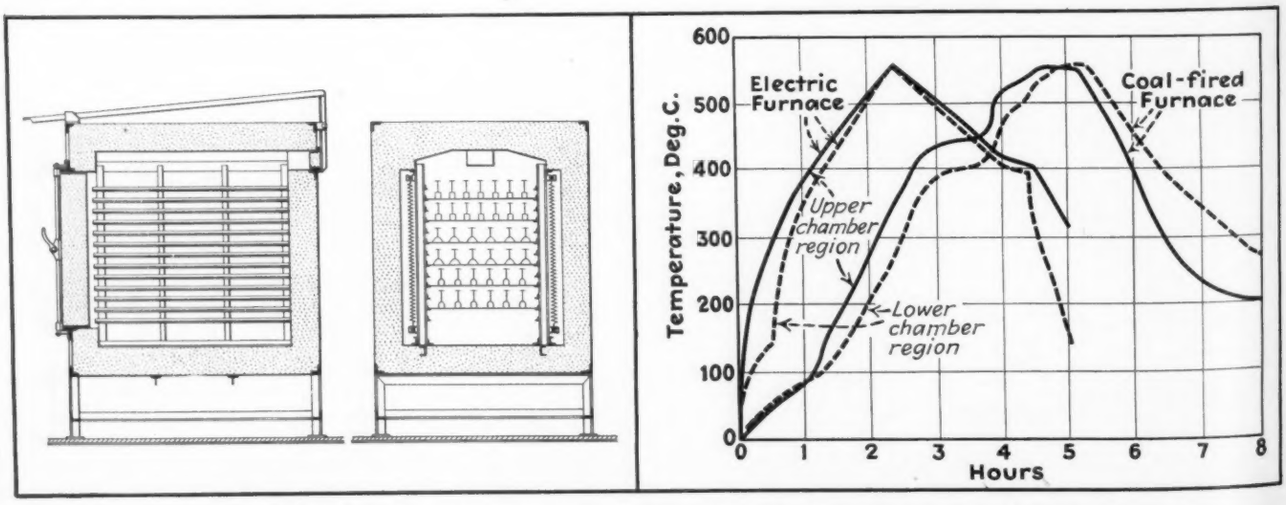
In the electric furnace the heating-up period is reduced to 2½ hours. At 450 deg. C. the greatest difference in temperature between parts of the chamber does not exceed 5 deg. C., and at the peak the difference does not exceed 2 to 3 deg., which limit it is possible to maintain without difficulty. Further advantages of the electric furnace to be noted are that it may be switched on and off automatically and temperature and heating time controlled automatically.

Compact Design With Modern Breakers



In the new Alameda County (California) Courthouse power distribution is accomplished with a minimum of space through the use of modern fuseless, thermal air circuit breakers. Power for lighting and power circuits is brought in through the two carbon-break air circuit breakers and distributed through the switchboard panels. The latter consist of fuseless, thermal air circuit breakers of a modern design which is so compact that six 200-amp. circuits can be mounted in a space 5 by 1½ ft. in height and breadth.

The new breakers eliminate unnecessary outages and the expense of fuse replacement and, at the same time, provide complete overload protection for each circuit.

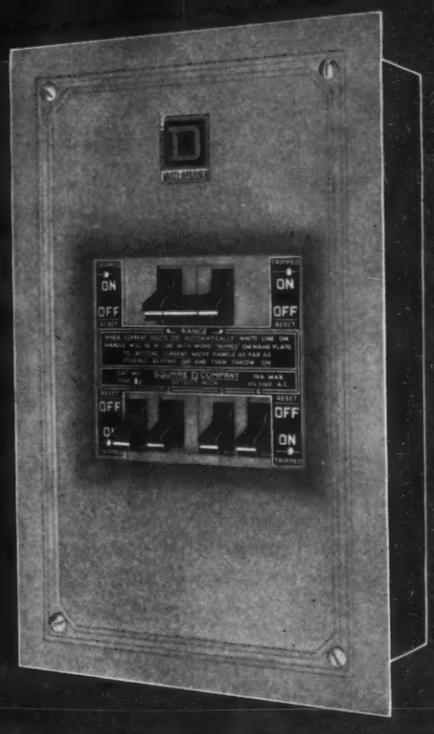


Cross-section drawing and temperature curves of electric furnace for firing glassware

Space between outer and inner casing is filled with well-rammed special insulating powder. Inner casing is of special heat-resisting metal and the door is either double or treble cased.

Dotted and solid lines show temperature difference in parts of the furnace. Rise in temperature in coal-fired furnace is both slow and irregular compared with that in electric furnace.

The New RAINTIGHT Multi-breakeR



Service Calls on Rural Lines Are Costly—

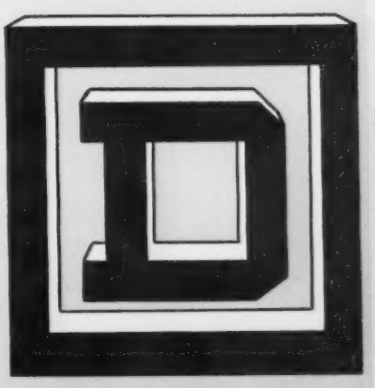
The SQUARE D MULTI-BREAKER reduces this expense

and builds good will

All service calls are an expense to the Public Utilities, but in outlying districts and on rural lines these costs become excessive. Greater distances, longer "outages," and comparative unfamiliarity with electricity among rural customers add to the cost and dissatisfaction.

The installation of Square D Multi-breakeRs will do much to relieve the situation. They provide circuit breaker protection at low cost—well within the means of the small home owner. They eliminate fuses and substitutes for fuses. They are safe and tamper proof.

Every Square D Multi-breakeR on your lines means a continuing cost reduction to you. Encourage their use for new services, remodeling, and for electric ranges and water heaters.



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UARE D COMPANY CANADA LTD. TORONTO, ONTARIO

CALL IN A SQUARE D MAN

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Electric Boiler Heats City Building

How electricity can be employed economically for the heating of water, such as in the conversion of building heating systems where hot water circulation is already installed, is demonstrated by the electric boiler installed in the Seattle City Light Building. It embodies mechanical and electrical features which are new in heating-unit design.

The boiler consists of 90 tubes, each 10 ft. long. Its capacity is 900 kw. Each of the 90 tubes is a two-tube assembly consisting of a 3-in. "fire" tube contained in a 4-in. water tube.

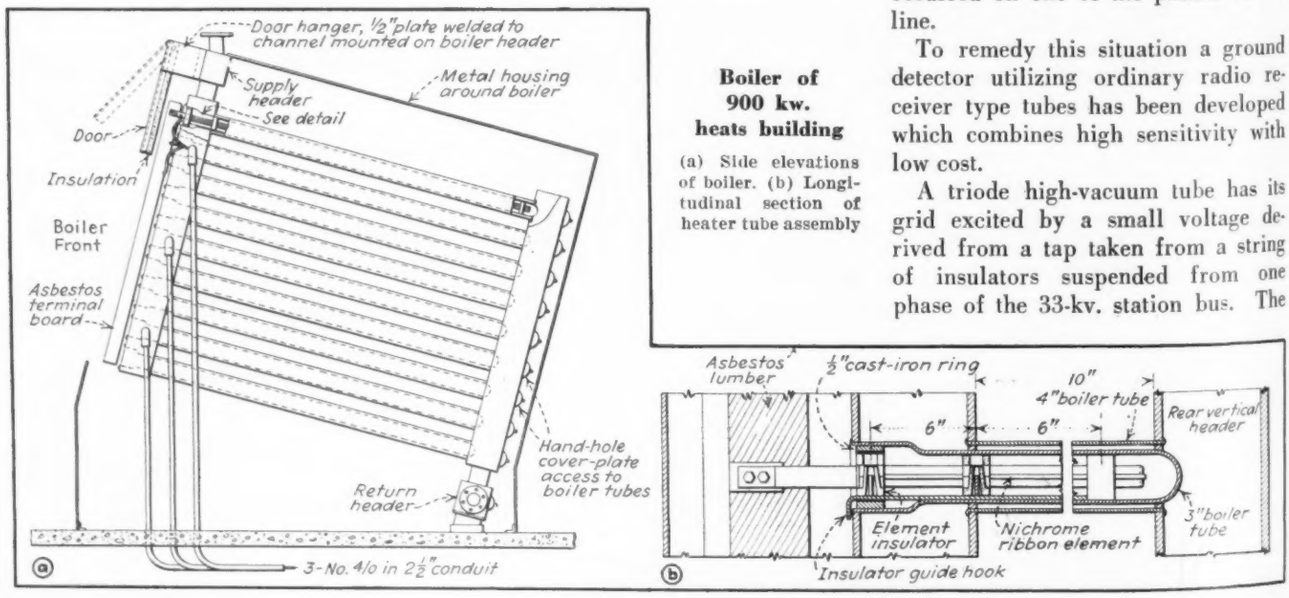
Nine tubes are mounted parallel in a vertical plane, with their axes at 15 deg. to the horizontal, between two vertical headers. Ten such sections are mounted side by side. Each section connects at rear bottom to a return drum and at front top to a supply drum. Water circulates upward and forward between the 3- and 4-in. tubes.

The 3-in. tubes are spun closed at the rear ends, which butt into the rear headers. The front ends are upset and belled to the outer face of the front header.

Each heating unit is a 10-ft., nichrome, U-shaped ribbon which is run into the 3-in. tube, closed end first by means of a guide hook carrying insulators which remains in the tube. Electrical connection is made to the U ends by welding to stainless steel bars.

The 90 units are divided electrically into six sections. The fifteen units of each section are star connected, ungrounded. Approximately 289 volts are impressed across the five units in series in each leg.

Three-point magnetic contactors, operated by air thermostats on the supply header, provide control. Contactors are cut out in steps between 160 and 180 deg., the maximum temperature.



Boiler of 900 kw. heats building

(a) Side elevations of boiler. (b) Longitudinal section of heater tube assembly

•

Locate Phase Grounds With Simple Detector

By A. H. BARDEWYCK
Transmission and Distribution Engineer, Cia. de Electricidad del Sud Argentino, Buenos Aires, Argentina, S. A.

Both the 2,000-kva., 33/13.2-kv. Mercedes substation and the 33/10-kv. Chivilcoy substation on the 37-mile, 33-kv. transmission line of the Cia. de Electricidad del Sud Argentino, Buenos Aires, interconnecting its Mercedes and Chivicoy plants, are unattended. Step-down transformers at both stations are delta connected on the "high" side and the transmission line has no connection to ground. Until recently no means existed of advising the system operator at the Mercedes power plant when a ground occurred on one of the phases of the line.

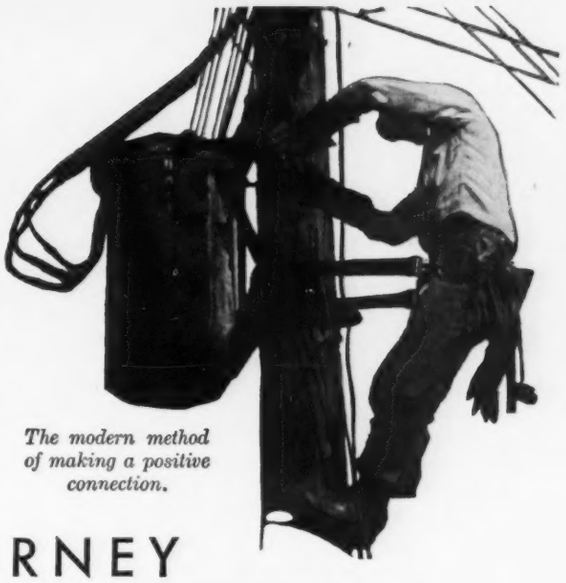
To remedy this situation a ground detector utilizing ordinary radio receiver type tubes has been developed which combines high sensitivity with low cost.

A triode high-vacuum tube has its grid excited by a small voltage derived from a tap taken from a string of insulators suspended from one phase of the 33-kv. station bus. The

THERE ARE

75 Standard Styles and Sizes

OF MECHANICALLY AND ELECTRICALLY PERFECTED



The modern method of making a positive connection.

- SOLDERLESS CON-NEC-TITES;
- T CON-NEC-TITES;
- LAP-TITE CONNECTORS;
- TRIP OUT FUSE SWITCHES;
- TRIP-O-LINK FUSE SWITCHES;
- TRIP SAVER FUSE SWITCHES;
- ONE AND TWO INSULATOR FUSE AND DISCONNECT SWITCHES;
- PORCELAIN HOUSED TRIPOMATIC FUSE CUTOUTS;
- DOUBLE DUTY FUSE CUTOUTS;
- ROLE TOP GANG OPERATED SWITCHES;
- PORCELAIN HOUSED DISCONNECT SWITCHES;
- N. E. M. A. HOOK OPERATED DISCONNECT SWITCHES;
- FUSE LINKS;
- FUSE LINK BOXES;
- FUSE PULLERS;
- SECONDARY FUSES;
- SCREW ANCHORS;
- EXPANSION ANCHORS;
- FULL-VU GUY GUARDS;
- GUY WIRE CLIPS AND STRAND BANDS;
- ECONOMY CABLE CLAMPS;
- DEAD-END SERVICE CLAMPS;
- V-GROOVE SERVICE CLAMPS;
- HITEMETERS;
- "J" HOOKS;
- CONDUIT STRAPS;
- ABC SLEEVES AND MACHINES;
- CABLE RING SADDLES;
- FIT-RITE WIRE HOLDERS;
- SLEEVE TWISTERS;
- GROUND WIRE CLIPS;
- GROUND CLAMP-TITES;
- GROUNDING CABLE;
- HI-LINE TOOLS AND ACCESSORIES;
- CON-NEC-TAP CLAMPS;
- GROUNDING SETS;
- MASTERWRENCHES

KEARNEY
CON-NEC-TITES

(The Con-Nec-Tite with Patented Full Round Washer)

Consider these

FEATURES OF KEARNEY CON-NEC-TITES

THE HEAD — fits securely into a standard hexagonal wrench. Rounded corners of body prevent nicking of conductors.

●

THE THREADS — are carefully gauged for pitch and accuracy to assure proper run of the nut and prevent binding.

●

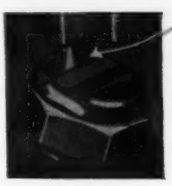
THE WASHER — is a full round washer and gives a smooth, low friction bearing surface; it distributes the load on the nut, and permits maximum pressure between conductors.

●

THE PILOT — is designed to "lead on" the nut; full threads at the bolt ends assure engaging nut properly and prevent cross-threading; full-sized threads throughout the bolt minimize nut friction and give maximum pressure between conductors.

●

THE RETAINER — is an optional feature that is available for those who desire it.



TAKE YOUR CHOICE

Above is one type of Con-Nec-Tite—Compressed Copper (Cold Drawn Process). Others available are: Large Head and Peanut Head Con-Nec-Tites (Screw Machine Process); Large Cast Con-Nec-Tites (Aluminum Bronze Casting); Telephone Con-Nec-Tites (Copper and Iron); and Compressed Aluminum Con-Nec-Tites (both of the latter Cold Drawn Process).

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Designed and Manufactured by

JAMES R. KEARNEY CORPORATION
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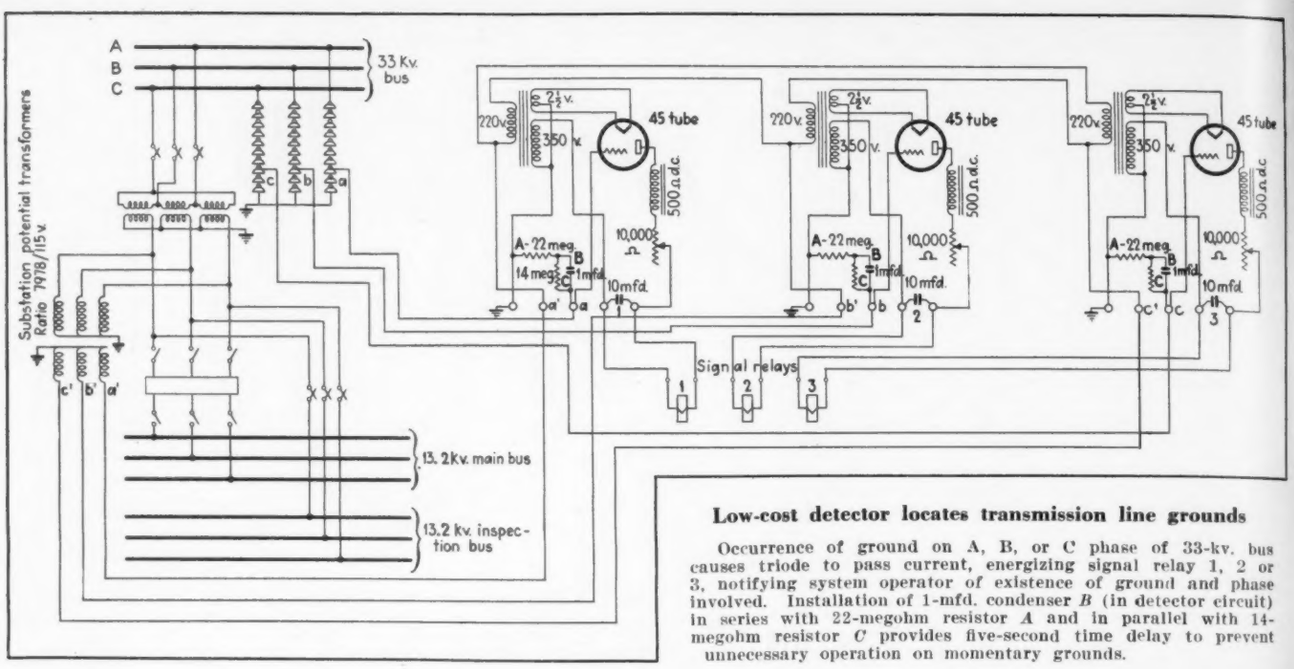


Low-cost detector locates transmission line grounds

Occurrence of ground on A, B, or C phase of 33-kv. bus causes triode to pass current, energizing signal relay 1, 2 or 3, notifying system operator of existence of ground and phase involved. Installation of 1-mfd. condenser *B* (in detector circuit) in series with 22-megohm resistor *A* and in parallel with 14-megohm resistor *C* provides five-second time delay to prevent unnecessary operation on momentary grounds.

lower end of the string of insulators is connected to the station ground. The plate of the tube is supplied with an alternating-current potential which is about 180 deg. out of phase with the grid potential, which can be obtained either from the station potential transformers, as was done at Mercedes, or from the station service transformers. A single triode with its corresponding string of insulators for grid excitation and plate supply is required for each phase of the line.

If no ground exists on the transmission line the action of the triode is blocked during the positive half-cycle of the alternating-current plate supply due to the fact that the grid of the tube is made sufficiently negative from the tap on the 33-kv. insulator string to prevent flow of the plate current. Should a ground occur on any phase, however, the grid of the triode controlling that phase will no longer receive excitation, since that phase is at ground potential. Therefore during the positive half-cycle of the plate supply current will flow in sufficient quantity to operate relay 1, 2 or 3, depending upon which phase becomes grounded.

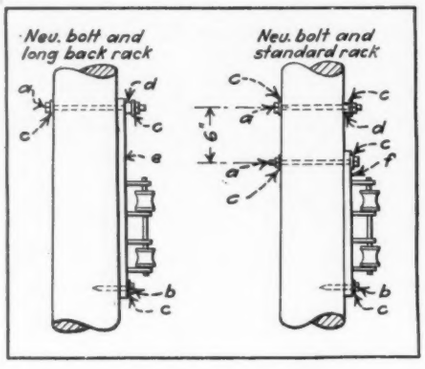
With the operation of relay 1, 2 or 3 the signaling equipment is put in operation and a periodic signal is sent over the transmission line telephone for approximately fifteen seconds, thus advising the system operator at the Mercedes station that a ground has occurred. Upon transmitting about twenty telephone signals, the signaling equipment is shut off through operation of a thermal relay. At the same time one of three white signaling lamps is left lighted, indicating which phase has been grounded.

Uninsulated Neutral on New Secondary Rack

By E. A. BOWMAN
Bowman & Wages, Roxie, Mass.

Many companies continue to insulate neutral conductors solely because most available materials provide that insulation. Others use a separate support for the neutral and a standard rack for the hot legs. While this latter arrangement is more flexible, it makes a saving only where the neutral alone is installed, as the cost of the complete installation for three conductors is slightly higher than that for a three-spool rack. We have designed an installation that gives the flexibility of the isolated neutral support, allows for the addition of hot leg supports with the minimum expenditure for material and labor, and the total installation provides a saving under present costs.

As shown in the sketches, when only the neutral is present, it is carried on the neutral bolt assembly. This assembly is made up of a bolt, washers and something to support the neutral conductor, as a one-bolt guy hook, a special item, or a ¾-in. length of ¾-in. galvanized pipe, as is shown. When secondaries are present the neutral bolt is used as a bolt at the top of a "long back" rack. This rack is the standard three-spool type with the top spool omitted. This permits doubling with present installations, etc. Should it be desired to add the racks after the neutral has been installed it is only necessary to withdraw the bolt and insert it through the rack.

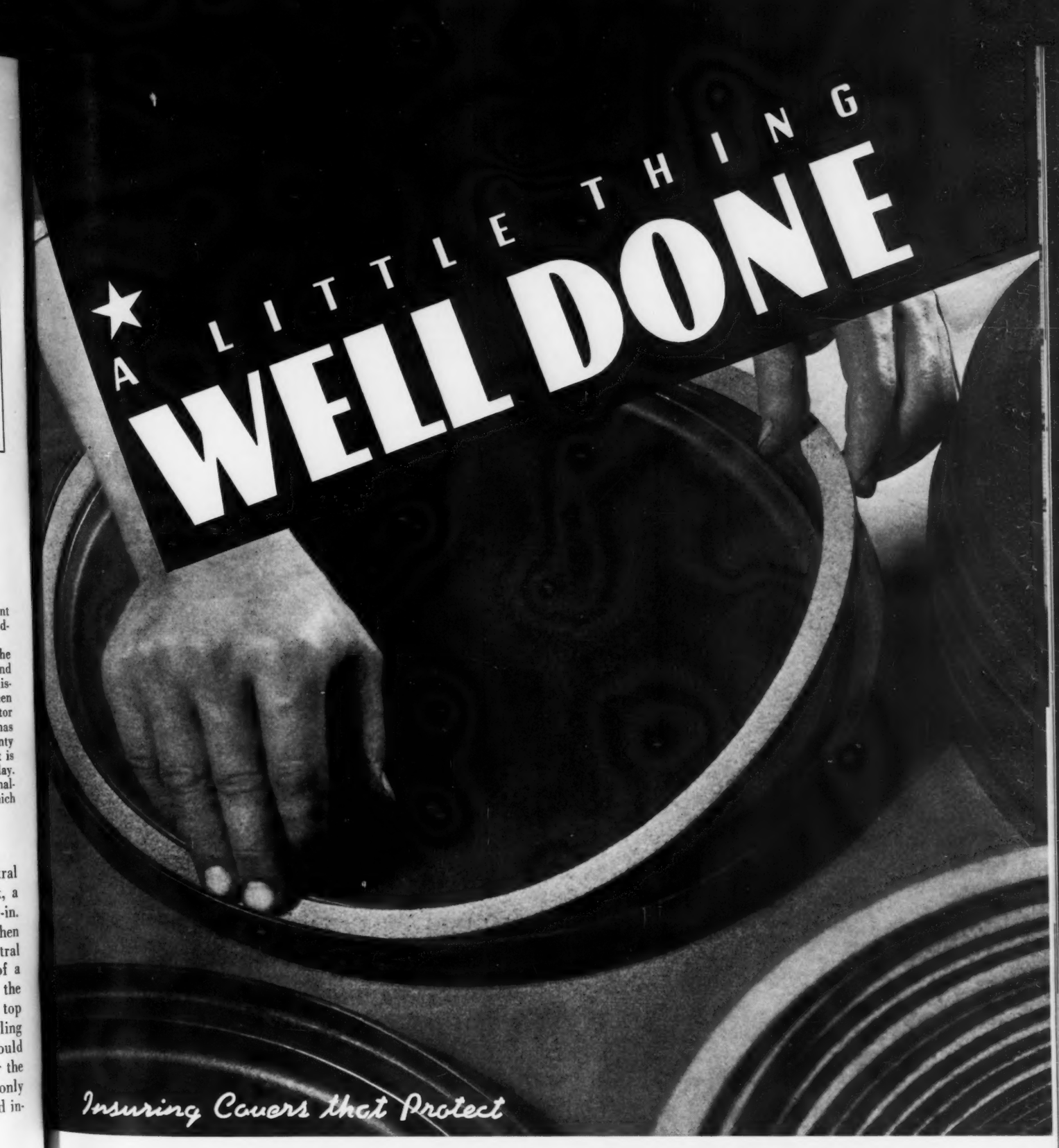


Costs less for long rack and uninsulated neutral

Some labor costs are common to all and are omitted. Other figures are not quotations, but close enough for comparative purposes:

	Unit Cost	Neutral Bolt	Neu. Bolt and 2-Spool Rack	3-Spool Rack	Neu. Bolt and 2-Place Long Back Rack
Labor boring hole and installing bolt	$0.20	$0.20	$0.40	$0.20	$0.20
Neutral bolt assembly	0.15	0.15	0.15	.....	0.15
½-in. bolt, 2 washers	0.10	.....	0.10	0.10	.....
½-in lagscrew and washer	0.05	.....	0.05	0.05	0.05
2-spool rack, with insulators	1.00	.....	.....	1.00	.....
Long back rack, 2 insulators	0.80	.....	.....	.....	0.80
		$0.35	$1.40	$1.35	$1.20

The 15 cents saving per installation may not be very much, but where several thousand installations a year are made it will total to an appreciable amount.



on L-M DISTRIBUTION TRANSFORMERS

The oil stays inside L-M Transformers . . . and moisture stays out. L-M covers are rigid cast iron, uniformly tight-fitting. A cork gasket is carefully fitted into the double-ridged channel seat on every L-M cover, making sure that your L-M Transformer is both oil-tight and moisture-proof. Another of the many "little things well done" to make L-M Transformers give more years of service. Write to South Milwaukee, Wisconsin, for transformer information.

LINE MATERIAL CO.

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Traveling Coach Sells Cookery

Combining eye appeal, portability and demonstration advantages, a new selling idea has proved to be a load builder for the Southern California Edison Company, Ltd. When the new-business department of that utility decided on a sales drive to convert southern California restaurants to modern electric cookery a large streamlined trailer was fitted as a traveling all-electric commercial cookery exhibit. It contains a comprehensive array of the latest types of electrical equipment for every possible cooking need in a restaurant, including a new electric food-warming table divided so that the different foods can be kept at various temperatures.

The exhibit is parked near the local office in each city and prospects are brought in to see the display. Direct mail, newspapers and personal contact acquaint restaurant owners of the dates the exhibit will be open for inspection.

•

Air Conditioning Increases in Chicago

Increases of 37 per cent in number of installations and 55 per cent in capacity of air-conditioning load added in 1936 as compared with 1935 are reported by the Commonwealth Edison Company, Chicago. Installations in Chicago now total 1,366, with a combined capacity of 57,725 hp.

Thirty-five new installations with a capacity of 1,623 hp. were reported for the last three months of the year. This was a 66 per cent increase in number and a 280 per cent increase in capacity over the corresponding period of 1935.

Among the outstanding features of the year's statistics was the amount of load contracted for in December. Contrary to the usual winter slump, December had the third highest monthly total for the year, sixteen new jobs being installed or contracted for with a capacity of 1,205 hp. This was an increase of 78 per cent in number and 560 per cent in capacity over December, 1935.

July accounted for more than a quarter of the year's installations. In that record-breaking month the greatest in number of units installed or contracted for, 112 new plants were reported with a capacity of 753 hp.;

Mountain brought to Mahomet

The traveling restaurant exhibit used by the Southern California Edison Company, Ltd., to promote commercial cookery. Interior shows the neat, compact arrangement of equipment. At the right, S. L. Cipperly, Edison's commercial cooking specialist, demonstrates a new electric food-warming table.

GENERAL MANAGER:
"I HAVE BEEN READING THOSE HEMINGRAY GLASS INSULATOR ADVERTISEMENTS. DOES THAT BRASS BUSHING REALLY MAKE GLASS A MORE PRACTICAL INSULATOR FOR POWER LINE USE?"
DISTRIBUTION ENGINEER:
"YES, INDEED! THE BRASS BUSHING ELIMINATES ALL THE OLD TROUBLES CAUSED BY PIN EXPANSION, AND THE TOUGHER GLASS NOW USED MAKES HEMINGRAYS IDEAL FOR LOW-COST SERVICE ON ALL DISTRIBUTION AND RURAL LINES. WE HAVE MADE THEM STANDARD FOR ALL OUR LINES, 15,000 VOLTS AND UNDER."

● Every engineer seeks high efficiency at moderate cost. For distribution line insulation, you'll find both in HEMINGRAY brass-bushed pin-type glass insulators. Their performance in service backs up the judgment of the man who buys them.

If you haven't tried HEMINGRAYS, order some today from your jobber or write for samples and prices.
Owens-Illinois Glass Company, Hemingray Division, Muncie, Indiana.

● Brass-bushed for greater strength, perfect threads and full protection against pin expansion.

● Hemingray provides many advantages: greater mechanical strength . . . sustained dielectric strength . . . unaffected by sudden temperature changes . . . withstands maximum insulator pin expansion . . . never ages or deteriorates . . . controlled uniformity of product . . . all surfaces impervious to moisture . . . tougher — withstands rough handling . . . clear, flawless for easy inspection.

FOR MODERN POWER LINE INSULATION
Order HEMINGRAY Glass INSULATORS

Air-Conditioning Load Added in Chicago in 1935 and 1936

	1936	1935		1936	1935
Banks	2	0	General offices	58	31
Bakeries	1	1	Private offices	91	61
Barber shops	3	0	Residences	48	24
Investment houses	6	0	Restaurants	66	51
Beauty parlors	3	7	Candy shops	15	8
Civic buildings	1	0	Clothing stores	20	16
Clubs	3	0	Fur stores	6	3
Church	0	1	Shoe stores	10	8
Doctors' and dentists' offices	9	11	Food stores	4	0
Drug stores	13	14	Miscellaneous stores	14	9
Hospitals	3	7	Undertakers	12	11
Hotels	4	2	Theaters	18	31
Candy factories	10	5	Broadcasting studios	0	2
Printing plants	3	5	Total	433	317
Miscellaneous industrial uses	10	9			

this was an increase of 86 per cent in number over the corresponding month in 1935.

March registered the greatest capacity for the year. Twenty new plants were installed with a combined capacity of 1,463 hp. This was an increase in capacity of 268 per cent over the 398 hp. capacity reported in March, 1935.

Indications for 1937 are that air conditioning in Chicago will experience another record-breaking twelve months. The record for December and negotiations and surveys now being made show that the public realizes the necessity of preparing in winter months for the summer benefits of air conditioning.

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Sports Illumination Nets 12 F.C. on Field

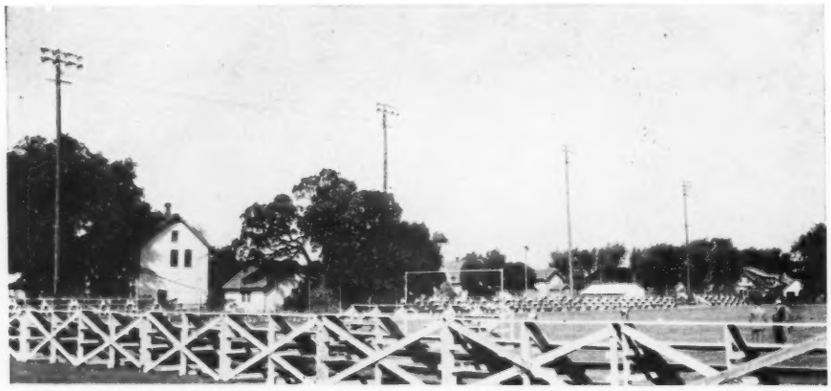
What is said to be one of the finest athletic field floodlighting installations in Wisconsin has been made at the Oshkosh High School field by the Wisconsin Public Service Corporation. This installation, made on a "no-profit" basis at an approximate cost of $3,165, totals 115 kw.

Sixty-four type MUA-1 Crouse-Hinds floodlights were used in the installation to provide an average intensity of 12 ft.-candles on the playing field. These fixtures were mounted on four equally spaced poles on either side of the field. The end poles were 70 ft. long, the inner two were 75 ft. long. Each pole was fitted with two 8-ft. fixture crossarms equipped with four 1,500-watt fixtures each and a 6-ft. platform arm to facilitate relamping. The two poles nearest the transformers were wired with two 350,000-circ.mil and one No. 2/0 neutral. Remaining poles were wired with two No. 4/0 and one No. 2 neutral. This provided a voltage drop of 3 volts between the transformer and the last lamp.

Floodlights used were graduated in horizontal and vertical degrees, a feature that made it possible, with the aid of a focusing chart, to set the fixtures at proper focus in the daytime and insure proper lighting. The fixtures, made of aluminum finished in Alzak, had a 70 deg. spread. Efficiency of the reflecting surface was said to have made it possible to place the poles behind the bleachers and yet maintain proper intensities. Lamps used in the fixtures were of the 105-volt, 1,500-watt PS-52 inside-frosted type. These lamps burned at an overvoltage of about 16 per cent and delivered approximately 39 per cent more light.

Switching of the field lights was done with a primary oil switch with a remote control button in the ticket office. The metering is an application of the conventional secondary current transformer-meter type.

Transformers to serve the installation, owned by the Wisconsin Public Service Company, will be used at the field only during the season, arrangements having been made to shift transformers from the local fair grounds for the purpose. The utility company will be responsible for changes each season at a $30 maximum fee.



Athletic field floodlighting installation yields 12 ft.-candles on playing area—Installation totals 115 kw. and cost $3,165

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Load Building for Profit

Five electric refrigerators were sold to a chain of five drug stores in Montreal, Canada, to maintain controlled preservation of serums and vaccines. Frozen vaccines are kept in the chiller tray; those which require a temperature of only 40 to 45 deg. are kept in conveniently sized metal containers inside the box. Common practice of most druggists in the city, the account says, is to keep the biologicals in an icebox in the back of the store. The druggists using the electric refrigerators keep them prominently displayed and have the story of their contents painted on the front of the cabinet; they declare their sales of vaccines have increased very considerably since they adopted this new method of merchandising.

Two very deep artesian wells supply drinking water for the 700 employees of the L. S. Starrett Company of Athol, Mass., at 42 drinking stations which now use electric water coolers. Bleeders were formerly used at each station to provide cold water; the saving in water to the company through the use of coolers appears to be about 5,000 gallons each working day of nine hours.

Installations of electric kitchens, including electric refrigeration, in a 62-suite Massachusetts apartment house reduced vacancies from sixteen to four and increased the gross income of the building by more than 30 per cent. Previously, the building was equipped with a central plant refrigerating system and gas ranges in fair condition. Following the installation, tenants were advised of the improvements and of the necessary boost in the rental scale, and the fact that the suites were equipped with electric refrigeration and ranges was advertised moderately. "We are convinced that the complete electrification of the kitchens is the most advisable step we can take for the improvement of clientele and income in our medium- and high-grade properties," says the rental agency.

THE INSIDE TRACK

The inside track is always the position that is preferred. . . . In 1906 a patent was granted us on the original nickel-chromium resistor, Chromel. Until then, the heating appliance industry had been thwarted because of the lack of what Chromel proved to be. We thus have an inside track with that industry, and with it have had close and friendly relations for 30 years—have always been aware of its heating element problems, with a mutual sharing of all the facts—have consistently lowered prices as increased production has lowered our costs. We have helped experimenters. . . . In doing these things, we have held our inside track position, from which we have continually learned as we have steadfastly tried to help. And this is why the electric heating industry has such confidence in Chromel for its heating elements. . . . Hoskins Manufacturing Co., Detroit, Mich.

H O S K I N S

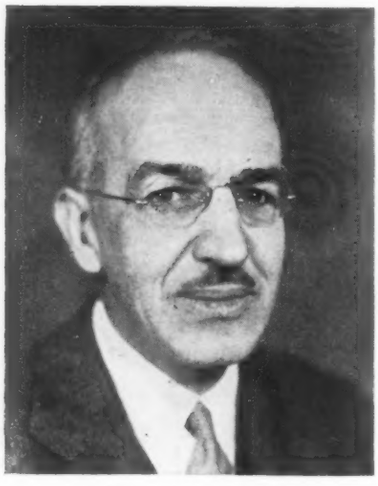
CHROMEL

THE WIRE THAT MAKES ELECTRIC HEAT POSSIBLE

News ABOUT PEOPLE

Tapscott and Fogg Assume New Executive Duties

Ralph H. Tapscott, who was elected last week president of the Consolidated Edison Company of New York, has had a distinguished career as an electrical engineer. He entered the employ of the New York Edison Company twenty years ago as assistant chief electrical engineer. In 1925 he was promoted to electrical engineer and in 1932 became vice-president of that company and of the United Elecric Light and Power Company. In 1936 he was elected vice-president of Consolidated Edison Company. For the last five years Mr. Tapscott has been coordinating the engineering, construction and operation of the electric companies affiliated with Consolidated Edison. He is a fellow of the A.I.E.E. and has served as a vice-president and director as well as chairman or member of several of its committees. As chairman of the electrical apparatus committee of the old National Electric Light Association he started a system of round-table discussions of operating problems which resulted in many improvements in electrical design.



Ralph H. Tapscott

Oscar Fogg

Oscar Fogg, who was elected to the newly created position of vice-chairman of the board, entered the gas industry with the United Gas Improvement Company in Philadelphia. In 1904 he became identified with the Consolidated Gas Company, New York. Subsequently he was assigned to research work in connection with gas manufacture and kindred subjects, and following distinguished service with the A.E.F. in France he returned to Consolidated Gas as vice-president in charge of commercial relations, customer service and utilization. In 1932 he was elected a vice-president of New York Edison Company and in 1935 he became executive vice-president of Consolidated Gas.

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▶ W. B. L'HOMMEDIEU, Westinghouse Electric & Manufacturing Company, San Francisco, has been elected president of the San Francisco Electrical Development League.

▶ CHARLES F. SCHABER of Bucyrus, Ohio, has been named chairman of the Ohio Public Utilities Commission by Gov. Martin L. Davey. Mr. Schaber's term will expire February 1, 1939. His designation as chairman followed the appointment of DENNIS F. DUNLAVY of Ashtabula as a member of the commission, succeeding Chairman E. J. Hopple of Cleveland.

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Carrier Corporation Makes Driscoll Vice-President

William H. Driscoll, formerly vice-president in charge of mechanical equipment with the Thompson-Starrett Company, has become associated with the Carrier Corporation, Newark, N. J., as vice-president in charge of construction. A past-president of the American Society of Heating and Ventilating Engineers, Mr. Driscoll has been active also as a member of the executive committee and council. As vice-president of Thompson-Starrett Company he was in charge of heating, ventilating, air conditioning, refrigerating and electrical work. With the Carrier Corporation Mr. Driscoll will have complete supervision of all installations of Carrier equipment.

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▶ JOHN S. DAVIDSON, manager of the air-conditioning department of the Nebraska Power Company, has become

YUH KNO', FRED, I'VE PULLED LOTS OF CABLE IN MY DAY..... SOMETIMES IT'S WORK.. AND HOW...I WISH OUR WHOLE SYSTEM WAS ORANGEBURG.... .....NEVER ANY FREEZING TROUBLE WITH THAT CONDUIT...IT'S GOOD FOR A L···O···N···G PULL LIKE THIS....AND...
YOU SAID IT !
MEN AT WORK
ORANGEBURG
THE FIBRE CONDUIT COMPANY
ORANGEBURG N.Y.
SALES AGENTS
GENERAL ELECTRIC SUPPLY CORP
GRAYBAR ELECTRIC CO.

associated with the Pennsylvania Power & Light Company under the supervision of L. W. Heath, executive vice-president.

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Oklahoma Utilities Group Elects Officers for 1937

The following have been elected officers of the Oklahoma Utilities Association for 1937: President, J. P. Arnold, Public Service Company of Oklahoma; first vice-president, J. Y. Wheeler, Community Natural Gas Company; second vice-president, Glenn C. Kiley, Oklahoma Gas & Electric Company; secretary-treasurer, W. R. Emerson, Oklahoma Gas & Electric Company, and acting secretary, Miss Kate A. Niblack.

The chairman of the electric light and power division is R. W. McClure, Oklahoma Power & Water Company.

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M. S. Bandoli Appointed to New Kelvinator Position

Appointment of Marvin S. Bandoli as sales manager of the domestic refrigerating division of Nash-Kelvinator Corporation has been announced by H. W. Burritt, vice-president in charge of sales. Mr. Bandoli will direct the promotional and sales activities of Kelvinator's enlarged domestic refrigeration merchandising force,

now embarked on the greatest campaign in its history.

Expert handling of merchandising problems as regional manager of the Southwest led to Mr. Bandoli's promotion. Before joining Kelvinator in 1931 Mr. Bandoli was active in sales promotion for the Wisconsin and Minnesota Light & Power Company, the Northern States Power Company and the Illinois Power & Light Company.

Mrs. Kenneth B. Norton was elected a member of the board of directors of the Westchester Lighting Company, Mount Vernon, N. Y., at the recent meeting of stockholders. Her appointment is in recognition of the growing importance of the women's viewpoint in the utility business

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▶ JAMES B. CASEY has been appointed director of public relations for the New England Power Association.

▶ HERBERT A. WAGNER, president of the Consolidated Gas, Electric Light & Power Company of Baltimore, has been elected a member of the executive committee of the Baltimore Association of Commerce.

▶ PAUL J. RAVER has been appointed executive assistant to James M. Slattery, chairman of the Illinois Commerce Commission. Mr. Raver has been chief of the rates and research sections of the commission for several years. E. D. OSTRANDER has been selected to succeed Mr. Raver.

▶ JOHN MAY, assistant general manager of electrical wire and cable sales, American Steel & Wire Company, Worcester, Mass., has been appointed vice-president and general sales manager of the company with headquarters at Cleveland, Ohio, Mr. May on March 1 succeeded Dennis A. Merriman, who will shortly retire under the company's pension's system

▶ HAROLD C. HAMILTON, superintendent of the Boston Edison Company's department of standardization and testing, has been elected chairman of the New England Electrical Equipment Committee, a group of engineers representing various northeastern power systems which meets periodically to discuss problems of special interest to central stations. He succeeds E. B. Curdts of the Narragansett Electric Company, Providence, R. I. E. Carlson of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., was elected vice-chairman, and R. D. Harrington of the Electric Storage Battery Company, Boston, was re-elected secretary.

▶ L. O. DORFMAN, manager of the engineering division, Westinghouse Electric & Manufacturing Company, Cincinnati, has been made engineering manager of the New England district of that company with offices at Boston, Mass.

▶ N. E. JENNISON has been appointed senior engineer in the sales division of the Penn Electric Switch Company, Des Moines, Iowa. Mr. Jennison was formerly instructor on oil burner installation and service in the Essex County Vocational School, Newark, N. J. "Mr. Jennison's appointment to take charge of dealer service meetings and service school work, as well as the training of sales engineers, has been made so that Penn Electric Switch Company may broaden its activities in both of these directions," said Nelson B. Delavan, vice-president and director of sales of Penn, in making the announcement.

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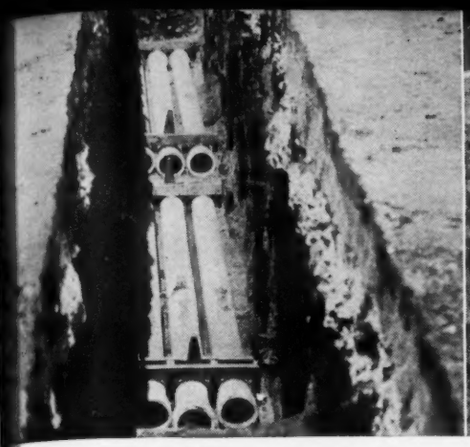
OBITUARY

▶ J. M. LOVATT, for more than 25 years associated with the staff of the British Columbia Electric Railway Company in the capacity of electrical engineer, died recently in Vancouver, at the age of 47.

▶ GERALD I. CARPER, a sales engineer of the Boston office of the General Electric Company, specializing in building equipment, police radio service and home development work, died, from a heart attack, in Newton, Mass., March 10. He was in his thirty-sixth year. Mr. Carper was a director of the Engineering Societies of New England.

▶ STANLEY TABER, assistant general manager in charge of sales for the Iowa-Nebraska Light & Power Company, died recently in his forty-third year. Mr. Taber was born in Rock Island, Ill. In 1921 he joined the Peoples Light Company in Davenport, Iowa, and the Iowa-Nebraska Light & Power Company in 1925 in Lincoln, where he had since that time resided.



CHICAGO, ILL. Another Transite Conduit in-lation... this time on the distribution system street railway. Here, too, lasting cable protec- is assured by Transite's resistance to corrosion; unity to rot and decay.

AT JACKSONVILLE, FLA. A municipal installation of Transite Korduct on multiple-duct transmission lines. Lighter in weight, lower in cost than Transite Conduit, Korduct is the ideal permanent conduit for all "concreted-in" jobs.

AT STATEN ISLAND, N. Y. Immediate savings on this utility installation . . . because the conduit is J-M Transite Conduit . . . and this permanent, strong asbestos-cement material eliminates "concreting-in" costs.

. . . each new installation of J-M Transite Conduit and Transite Korduct writes another page into a growing record for greater permanence and economy on every type of distribution system

EXPLAIN the established popularity of J-M Transite Conduit ... account for the remarkable acceptance of its recently introduced, thin-walled companion... Transite Korduct?

It's simply that an ever-increasing number of men, concerned with lowering electrical distribution costs, have found that the use of one or both of these materials accomplishes just that.

More important to you, is the fact that Transite Conduit or Korduct offers *you* the same opportunity to lower *your* distribution costs . . . and to keep them low! Read how they meet the following service requirements . . . and you'll see why . . .

Underground without an envelope

On service of this type, Transite Conduit provides immediate installation savings. Strong enough to be laid without an envelope, its use eliminates all "concreting-in" costs. Savings are therefore large—and particularly so on systems involving one, two or three ducts. Added to this economy are further savings throughout the years. An asbestos-cement product, Transite Conduit is corrosion-resistant and imperishable . . . hence, virtually maintenance-free.

In all exposed locations

Outdoors or indoors, Transite Conduit proves equally effective in lowering distribution costs. For here, too—because of its strong, weatherproof and incombustible composition—is the same assurance of years of service, at negligible upkeep.

Where "concreting-in" is needed

In multiple-duct transmission systems . . . in tunnels . . . bridge structures or dams . . . the service often calls for "concreting-in" of conduit. And that logically calls for the use of Transite Korduct. Identical in composition with Transite Conduit, but differing in its lesser wall thickness and lighter weight, Transite Korduct offers the same permanence, incombustibility and freedom from maintenance.

• • •

Whatever your distribution service requirements may be, both of these modern Johns-Manville materials are your best assurance of perfect conduit performance. For complete details, get our new data-sheet manual. Write Johns-Manville, 22 East 40th Street, New York City.

AT TRENTON, N. J. The conduit selected for service on this bridge structure was J-M Transite Korduct . . . thin-walled companion to Transite Conduit. Here, as on all jobs that call for "concreting-in," Korduct's light weight and long lengths sizably reduce material and handling costs.

Johns-Manville TRANSITE CONDUIT

for use underground without concrete envelope and for exposed locations

TRANSITE KORDUCT

for installation in concrete

JOHNS-MANVILLE JM PRODUCTS

Manufacturing AND MARKETS

Refrigerator Sales Seen at New Record

An inspection trip of Westinghouse Electric & Manufacturing Company plants at Mansfield, Ohio, and Springfield, Mass., during which sales meetings were held, was made by 125 top-notch Westinghouse refrigerator salesmen last week. Although past sales records were shattered predictions were made that new peaks would be reached this year.

R. C. Cosgrove, manager of household refrigeration sales, was host during the two-day stay in Mansfield. A. E. Allen, vice-president, and P. Y. Danley, manager of air conditioning and refrigeration department, were speakers at the meeting.

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Westinghouse Group Raises Sick Benefits

The relief association composed of employees of Westinghouse Electric & Manufacturing Company will increase, effective April 1, sick benefits. Weekly payments in the maximum class will be raised from $12 to $16 a week for the first thirteen weeks of disability and thereafter from $8.25 to $10 a week for as long as an employee is disabled if he has continuous membership for five years.

The relief association was organized by company employees in 1907 and to date has paid benefits totaling $8,500,000. More than 30,000 employees are members. The company contributes the cost of administration and matches death benefit payments.

•

Pennsylvania Contract

Pennsylvania Railroad has awarded the main line electrification contracts from Conestoga to Harrisburg and the Columbia-Enola freight line to the Arundel Corporation of Baltimore. The contract for the Thorndale-Conestoga link on the main line was awarded to the Vare Construction Company of Philadelphia. The other contracts had previously been awarded for the $50,000,000 project.

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Westinghouse Electric Gets Government Power Contracts

Westinghouse Electric & Manufacturing Company has secured contract from United States Engineer Office, Portland, Ore., for switchgear and bus material for Bonneville, Ore., power dam and hydro-electric power development project at price of $141,862. Also from the Bureau of Reclamation, Denver, Colo., for four 1667-kva., 16 500/34,500-volt transformers for Boulder Dam power plant at $26,134.37, and for one outdoor metering and relay cabinet, at $2,126.17, for the same station.

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Three Lighting Conferences

Dates for three lighting conferences to be held at the General Electric Institute, Nela Park, Cleveland, this spring have been set as follows: Regular elementary course for lighting salesman, May 3-6 annual advanced lighting conference, May 10-12, and conference on street and highway lighting operation, May 13 and 14.

•

Westinghouse Bonus

Westinghouse Electric & Manufacturing Company announced last week that the additional compensation under the company's wage and salary plan for March wages and salaries for all employees is 14 per cent. The 14 per cent represents $950,000, which the employees receive above the base rate of pay.

New Electric Range Sales Record Seen

Approximately 500,000 electric ranges will be manufactured and sold during this year, according to Pierre L. Miles, sales manager of Nash-Kelvinator Corporation. Mr. Miles makes his prediction on the basis of a survey recently completed and indicates an increase of 53 per cent over 1936 sales.

From 50,000 units sold in 1933, electric range sales have increased steadily, Mr. Miles said. In 1934 a total of 150,000 units were marketed, 200,000 in 1935 and 325,000 in 1936.

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Manufacturers Issue Annual Statements

Among the electrical manufacturing companies recently reporting 1936 operations are the following:

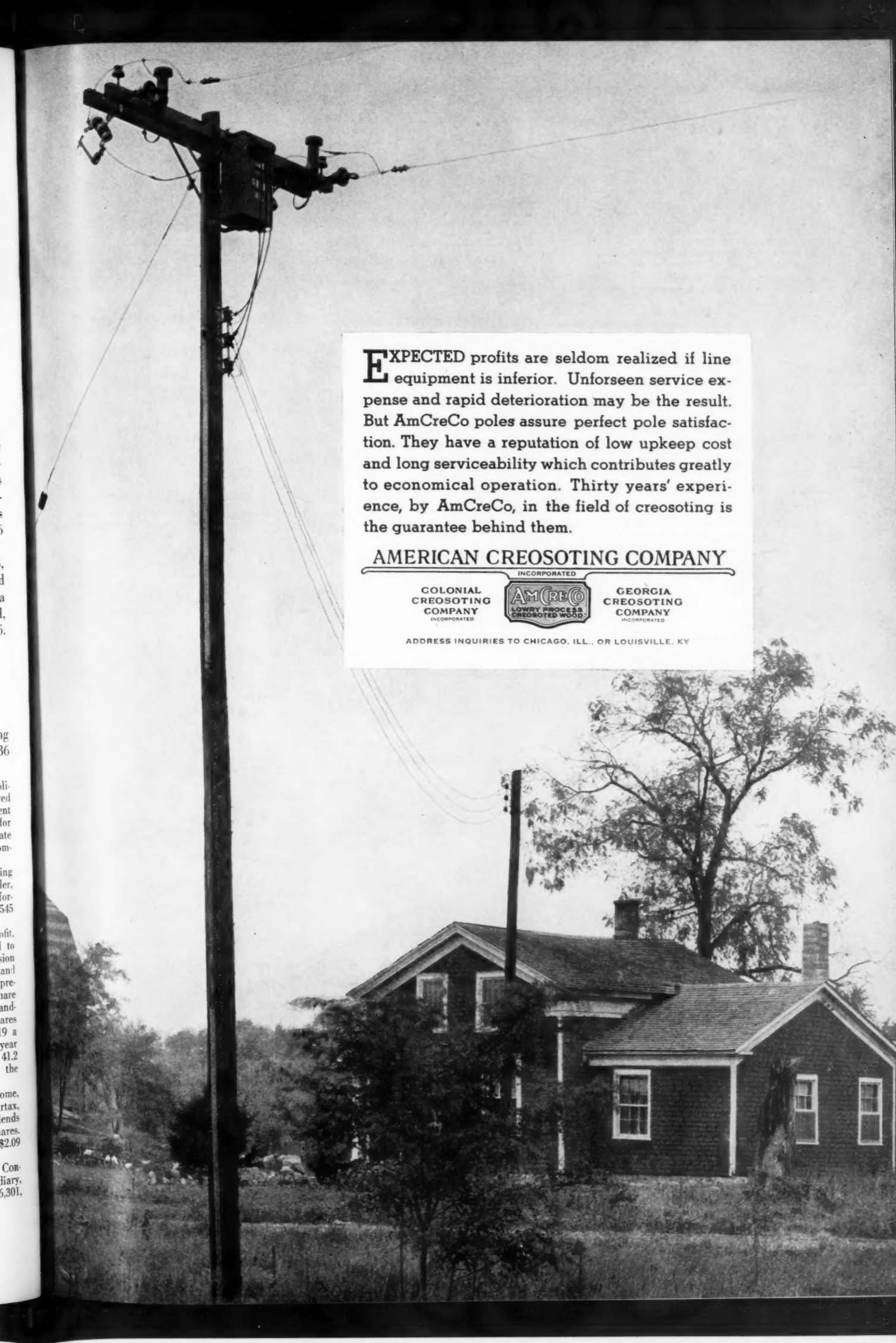
SANGAMO ELECTRIC COMPANY—consolidated net profit of $1,047,076, compared with $583,942 in 1935. This was equivalent to $7.43 a common share after provision for preferred stock dividends up to July 1, date of redemption, compared with $4.21 a common share in 1935.

FOSTER WHEELER CORPORATION—including subsidiaries, but excluding Foster Wheeler, Ltd., Canada, net loss, $244,559 after foreign income taxes, compared with $541,545 loss in previous year.

JOHNS-MANVILLE CORPORATION—net profit, including that of subsidiaries, amounted to $4,373,707 in 1936 after deducting provision for depreciation, depletion, obsolescence and Federal taxes. This is equal, after preferred dividend payments, to $5.13 a share on 750,000 shares of common stock outstanding at the end of the year. This compares with a net profit of $2,164,858, or $2.19 a share, for 1935. Net sales for the year amounted to $48,922,011, an increase of 41.2 per cent over the $34,646,853 reported the year before.

BIRTMAN ELECTRIC COMPANY—net income, including that of subsidiaries, after surtax, $382,285, equal after $7 preferred dividends to $2.80 each on 125,400 common shares. Net income in 1935 was $294,645, or $2.09 a common share.

WESTON ELECTRICAL INSTRUMENT CORPORATION—including domestic subsidiary, net profit after Federal surtax $256,301,



EXPECTED profits are seldom realized if line equipment is inferior. Unforseen service expense and rapid deterioration may be the result. But AmCreCo poles assure perfect pole satisfaction. They have a reputation of low upkeep cost and long serviceability which contributes greatly to economical operation. Thirty years' experience, by AmCreCo, in the field of creosoting is the guarantee behind them.

AMERICAN CREOSOTING COMPANY

INCORPORATED

COLONIAL CREOSOTING COMPANY INCORPORATED

AMCRECO LOWRY PROCESS CREOSOTED WOOD

GEORGIA CREOSOTING COMPANY INCORPORATED

ADDRESS INQUIRIES TO CHICAGO, ILL., OR LOUISVILLE, KY

equal under participating provisions of the shares outstanding at close of year, to $2.22 each on 27,376 no-par shares of Class A stock and $1.22 each on 160,583 no-par shares of common stock. This compares with $225,462, or 98 cents a common share earned in 1935.

CANADIAN WESTINGHOUSE COMPANY—Net income, $872,131, including $150,000 transferred from general reserve for depreciation and after taxes, depreciation written off, provisions for employees' pension fund and other charges. Net income in 1935 was $860,401. Capital stock amounts to 546,000 no-par shares.

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Air-Conditioning Orders Show January Increase

Value of orders booked for air-conditioning systems and equipment during January were slightly higher than in December, and greatly above that for January last year, according to estimates of the Department of Commerce.

During January the dollar value of orders for systems and equipment totaled $4,874,223, as against $4,399,693 in December and $2,358,247 in January last year.

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Proctor & Schwartz

Proctor & Schwartz Electric Company of Philadelphia is opening a new office in Chicago. Walter E. Trittipo will be in charge.

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Sales Representatives Named

Electrical manufacturing companies have recently made the following assignments in their sales staffs:

Leeds & Northrup Company has appointed L. E. Emerich assistant sales manager in the technical sales division, Philadelphia. Nathan Cohn has been transferred from the Pacific Coast to Chicago as district manager of technical division sales.

Triangle Conduit & Cable Company has appointed B. J. Fleming of Omaha district representative for the states of Nebraska and Iowa.

Reliance Electric & Engineering Company has added Elwood H. Koontz to its sales staff in Philadelphia.

Harry Troutwine, formerly New England branch manager of the Kelvinator Corporation, has been appointed branch manager of Standard Air Conditioning, Inc., a subsidiary of the American Radiator organization, with headquarters at Boston.

New York Metal Prices

	March 17, 1937 Cents per Pound	March 23, 1937 Cents per Pound
Copper electrolytic	16.25*	16.25*
Lead Am. S. & R. price	7.25	7.00
Antimony	16.125	16.50
Nickel ingot	35.00	35.00
Zinc spot	7.85	7.85
Tin Straits	65.50	62.00
Aluminum, 99 per cent	20–21	20–21

* Delivered Connecticut Valley.

Field Reports on Business

Activity in the electrical industry is moving ahead at a gratifying pace, promising a busy spring and summer as reports to ELECTRICAL WORLD *indicate. While continued sit-down strikes, precipitated by C.I.O., are discouraging and tend to upset production schedules, it is believed industrial peace may soon be expected. The major fear is a consumers strike against rising prices.*

PACIFIC COAST

All electrical branches report good business averaging 20 per cent over last year, and a coexistent fear of boom reaction is gradually disappearing before such solid evidence as crops, widespread consumer buying and busy industrials. Power projects and machinery buying by utilities feature the week, including a $500,000 rural electrification allotment for 350 miles of line and hydro plant to serve one thousand customers in northeastern California and a 3-mile, 69-kva. steel tower link for San Bernardino. Los Angeles is buying $5,000 trench cable, 1,000 ft. 500,000-circ.mil paper-lead, 2,500-volt cable, $8,000 circuit breakers, $7,000 transformers and $16,000 disconnecting switches.

An electrical contract of about $100,000 is soon to be figured for the Bay Bridge Terminal, which will also cause demolition and subsequent rebuilding of about ninety structures up to six stories. San Francisco's electrical budget includes $475,000 for conversion of a 4-mile crosstown trolley line to trolley buses. Final decision on both outdoor and indoor Golden Gate exposition lighting is still pending. Sales of electrical staples, stimulated by constant sharp price increases, are excellent; factory shipments are subject to delay, necessitating revision of construction schedules, and many coast stocks of conduit and wire are dropping to levels which give concern.

NEW ENGLAND

Sales of practically all kinds of important electrical supplies for the first quarter in this area will surpass the volume for the corresponding quarter in 1936 by a wide margin. Buying in many lines is progressing with a rush; for example, one nationally known manufacturer reports that March sales of electrical equipment will probably reach an all-time high; small motor orders are being received in heavy volume. Last week orders aggregating over $22,000 were placed for fractional-horsepower motors with one concern. Large motors for pumping purposes are being considered for several municipal projects.

Central station supplies are moving ahead. Transformer sales are steady; recently a 15,000-kva. transformer was purchased by a large utility; switch and control apparatus sales are strong. Line extension materials are receiving attention and, with very favorable weather conditions prevailing, an encouraging amount of construction for domestic service in the suburbs is at hand. Arc-welding units are in demand.

Merchandising is moving ahead rapidly. According to one well-known distributor, appliance sales are headed for new volume heights in this district provided the industrial stability now enjoyed in this district continues well into the year. Southern Vermont continues to be a fertile area for selling major electric appliances; refrigerator sales are about 15 per cent above last year; ranges are selling well. In the Boston area a heavy movement in refrigerators is under way.

NEW YORK

A great deal of uneasiness is being expressed in business quarters as a result of the increasing labor troubles. Sit-down strikes continue to spread in growing numbers, taking the lead from the C.I.O. union workers in the automobile centers. It appears now that the recent wage increase given steel workers was only an appetizer and demands for another boost is soon expected.

Higher prices are ruling generally, with a further hike in the not-too-distant future. Some reluctance on the part of consumers to purchase at the higher levels is being experienced.

Utility companies in this section are pushing electrical appliances to build up load. Many retail outlets are featuring the small appliances and report good sales. Building is showing a fast upturn, aiding electrical contractors. Modern wiring and lighting applications are catching the fancy of home builders who are turning to the all-electric kitchens. Air conditioning is showing rapid strides. Orders for heavy electrical equipment are expected in greater volume this spring.

Industrial Commissioner Elmer F. Andrews reports increasing numbers of men and women going back to work in private industry. The State Employment Service and the National Re-employment Service showed a total of 12,518 placements during February, a 14.9 per cent seasonal decline from January, but 36.6 per cent above February, 1936.

CHICAGO

Unless worse labor troubles are in store for business, it is expected there will be a sharp rise in the volume of all kinds of business over the next thirty days due to seasonal acceleration. The movement may carry further if prices continue to climb, thus inducing accumulations of a wide range of materials and goods. Despite a continuance of many strikes in this city, activity in nearly every industry showed improvement, or at least held steady. Approximately 150,000 workers in Chicago benefited from wage increases announced last week.

Electrical energy output for this area gained 4 per cent over the preceding week. Small motor sales were exceptionally good. Transformers are in steady demand, as are panelboards, switches and wiring devices. Contractors report a general pick-up in additional outlet installations. Among orders for equipment reported last week are 44,000 ft. 3½-in. fiber conduit, 44,000 ft. 3½-in. asbestos-cement conduit, 800 5-in. iron collars for pole extensions, 300 traffic signal bases, 1,200 glass fixture globes and 3,000 traffic signal lenses. The numerous inquiries received is evidence of public interest shown in the range campaign recently inaugurated in Chicago.

Burroughs

4 PAYROLL RECORDS *in* 1 WRITING

COMPLETE SOCIAL SECURITY RECORDS AT A LOW COST

To meet today's payroll accounting needs with a minimum of work and at low cost, Burroughs provides new machines, new features, new developments for writing the records described at the right. Concerns—large and small—in all lines of business—are benefiting by the speed, ease and economy with which one or several of these new Burroughs machines completely handle all payroll records. Investigate. For quick action, telephone your local Burroughs office or, if more convenient, mail the coupon or wire direct today.

1 THE PAYROLL

Complete payroll and check register in one unit shows the gross pay, all deductions, and net pay for all employees. Separate totals for all columns accumulate automatically.

2 EARNINGS RECORD

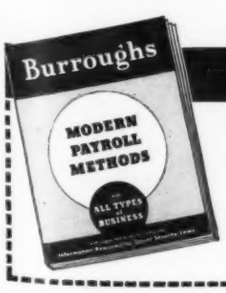
Complete individual progressive record for each employee shows time worked, gross earnings, deductions, and net pay for any and all periods. Provides information needed for old age benefits, unemployment insurance, and income tax reports.

3 EMPLOYEE'S STATEMENT

This receipt for deductions, which the law requires be given to each employee at each pay period, also shows the individual's gross earnings, all deductions, and net pay. It can be retained permanently by the employee.

4 PAY CHECK or pay envelope

Since the check or pay envelope is written with the above three records, the amount is in perfect accord with these records.



SEND FOR THIS NEW PAYROLL FOLDER!

BURROUGHS ADDING MACHINE COMPANY, 6453 SECOND BLVD., DETROIT, MICH.
Send me the new folder "Modern Payroll Methods"—which includes illustrations of forms for compiling figures required by the Federal Social Security Act.

Name_____ Type of Business_____

Address_____

New EQUIPMENT AVAILABLE

Power-Factor Capacitors

Announcement is made of a new line of outdoor capacitors for power-factor correction on public utility distribution systems. These capacitors are so constructed as to be

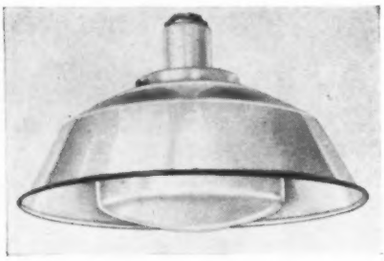
Supplied with one or two bushings, in ratings from 230 to 6,900 volts; two kinds available, one impregnated with Dykanol A, other with Dykanol C. **Cornell-Dubilier Corp.,** South Plainfield, N. J.

suitable for mounting on small frames directly on the poles; they do not need external housings. By using this construction, the installation and maintenance costs are kept at a minimum, it is claimed.

•

Mercury Lighting Fixtures

Designed to distribute the light from a 250-watt high-intensity mercury lamp where the mounting height is under 18 ft., this diffuser consists of a white porcelain-enameled reflector and a diffusing glass globe. Six openings at the top of the reflector permit some light to reach the ceiling. This fixture is one of a series designed for use with mercury vapor lighting; the series includes:



"Glassteel" diffuser. **Westinghouse Electric & Manufacturing Co.,** East Pittsburgh, Pa.

vapor-proof angle and dome reflectors for the 250-watt lamp, high-mounting aluminum and low-mounting dome reflectors for the 400-watt lamp.

•

Stainless Steel Electrode

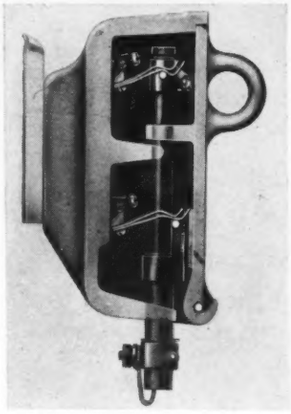
Furnished in 18-in. lengths with center grip in these diameters: 3/32, ⅛, 5/32 and 3/16 in. **Joseph T. Ryerson & Son, Inc.,** Chicago, Ill.

New electrodes are intended for the welding of all stainless steels in the 18-8 group, including those containing Titanium. Heavy, carbon-free coating produces a protecting gas shield around the arc; a brittle, friable slag protects the weld metal while cooling and may be removed with a wire brush. It is claimed that no difficulty is experienced in restriking the arc when the arc is broken several times with the same electrode, as when "tacking up" a job.

•

Primary Distribution Cutouts

When the fuse link parts in this porcelain-housed, dropdown-type, primary distribution cutout the outer fuseholder tube



Dropdown Matthews cutouts; N.E.M.A. rating, 50 amp., 5,000 volts. **W. N. Matthews Corp.,** St. Louis, Mo.

drops, instantly disconnecting the circuit and giving easy visibility of the outage. Door remains closed during this process, but both door and fuseholder are removable for re-fusing. Even with a current feed-back to the lower cutout contacts the lower end of the fuseholder is dead when in the open position, it is claimed.

•

Humidity Control

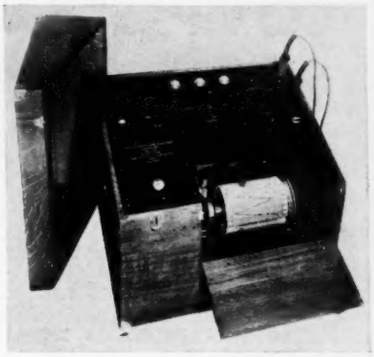
Humidity control; for use on 110-volt, 60-cycle a.c. **Julien P. Friez & Sons, Inc.,** Baltimore, Md., and **Supreme Electric Products Corp.,** Rochester, N. Y.

For use in the air-conditioning field, this simplified humidity control combines an insertion humidistat with a solenoid water valve. The humidistat is usually installed through the wall or casing of the "cold air return." Electrical contacts in the instrument operate the electric valve, which supplies moisture to maintain the humidity at which the pointer is set. Only one electrical connection is needed for the combination.

•

Transmission Line Analyzer

Recent improvements aid portability, speed of handling and calibration checking in this transmission line analyzer, for locating faults by the use of reflected high-frequency waves imposed on the circuit. They include:



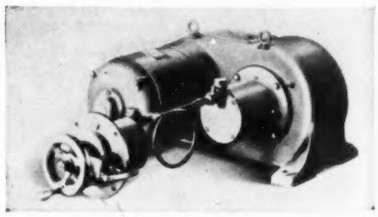
"Telemetrograph." **Tobe Deutschmann Corp.,** Canton, Mass.

a recorder with motor-driven pen controlled by an electromechanical bridge assembly, accurately reflecting changes in line impedance with frequency variation; record charts directly calibrated in frequency; drum-type chart carrier with adjustable speed control; provision for utilizing the power frequency as a calibration check, and integral cathode-ray oscilloscope for use in adjusting the beat-frequency oscillator to synchronism with the power frequency.

•

Speed Control

A new development for this company's Varidrive motors provides remote control of this variable-speed unit by hydraulic means. By turning the handwheel at the remote



Hydraulic remote control. **U.S. Electric Motors, Inc.,** Los Angeles, Calif.

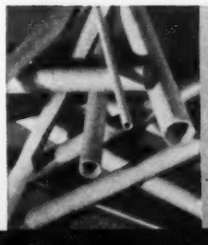
THE EVERLASTING VIGIL

To the everlasting watch along the coast, SYNTHANE laminated bakelite makes one vital contribution—dependability of the insulation in lighting and signalling circuits. Put that reliance into your product by using SYNTHANE.

SYNTHANE is a material possessing a combination of many desirable properties—electrical, mechanical, chemical and physical—for many purposes. Write for information and data sheets. SYNTHANE CORPORATION, Oaks, Penna.

SYNTHANE LAMINATED BAKELITE

SHEETS • RODS • TUBES • FABRICATED PARTS



SYNTHANE

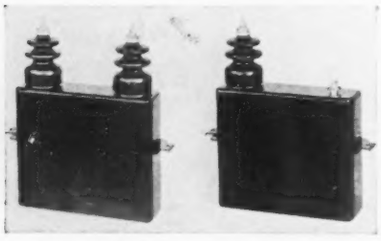
CORPORATION OAKS · PENNA

control station, liquid from the cylinder at this point is forced through copper tubing to the cylinder at the variable-speed unit itself. Movement of this cylinder changes the speed. Smooth regulation of speed within the range of the unit is said to be given by this scheme.

•

Distribution Capacitors

With the introduction of new pole-type distribution capacitors, power companies are now able to make more effective distribution of corrective kva., in smaller blocks and



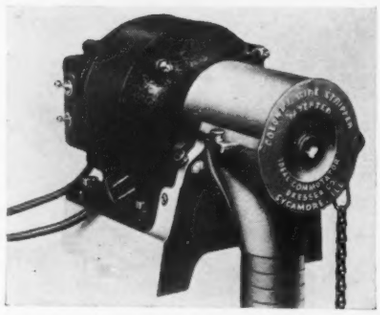
Class ID; available in 10- and 15-kva. sizes for 2,300- and 4,000-volt circuits and 15-kva. size for 4,600-, 6,900- and 11,950-volt, grounded-Y circuits. **General Electric Co.**, Schenectady, N. Y.

at more points over the entire feeder, says the manufacturer. Units are Pyranol-filled and can be mounted on a crossarm or bolted directly to the pole. Sturdy construction of this capacitor is featured by its drawn-steel case with the single resistance-welded joint. Additional safety is provided for linemen by built-in discharge resistors, it is said.

•

Wire Stripper

Said to be the first wire stripper to employ the principle of centrifugal action, which eliminates the necessity for springs and levers, this new wire stripper strips either from left to right or from right to left, at the turn of a switch. Double-edged blades in the stripping chamber fly outward and a slight pressure on the foot pedal



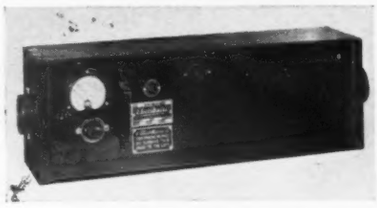
"Colonial", with ¼-hp. motor; 110-volt, 60-cycle and d.c. types. **Ideal Commutator Dresser Co.**, Sycamore, Ill.

closes the blades to within 0.001 in. of the diameter set by the dialed micrometer gage. When the wire is inserted into the stripper the insulation is cut clean, the wire properly twisted and polished and ready for terminals or soldering. Flexible metal tube carries waste strippings to disposal container.

•

Ozone Generator

For the first time, says the manufacturer, an ozone unit has been developed for attachment to the individual heating, ventilating or air conditioning duct. Air enters



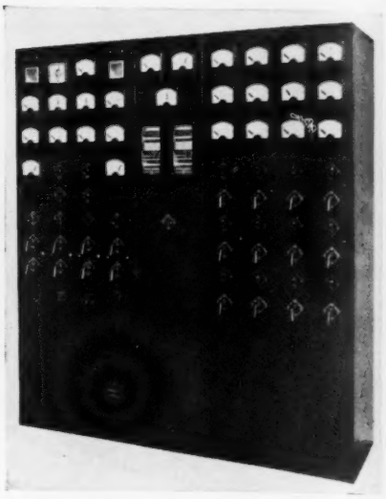
Model JR; in three sizes, with capacities of 3,000, 4,000 and 5,000 cu.ft. per minute. **Electroaire Corp.**, Chicago, Ill.

at the right end of the unit, is ozonated as it passes through and then is discharged into the duct at the left for distribution. Rheostat and meter on the unit permit regulation of the ozone generation.

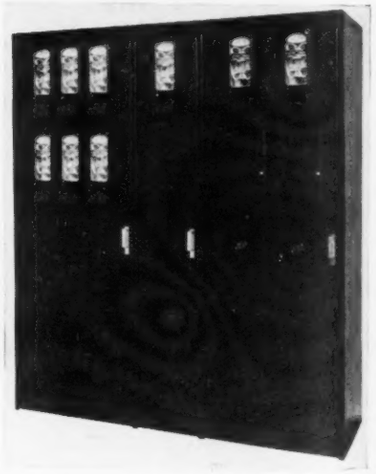
Duplex Switchboard

Metal-inclosed duplex switchboard. **Delta-Star Electric Co.**, Chicago, Ill.

Equipped with semi-flush instruments, this three-unit switchboard is used with a fifteen-unit metal-clad switchgear controlling two 1,500-kva., 2,300-volt generators and twelve feeders.



Left-hand unit (front view) contains controls and instruments for two generators, center unit carries voltmeters, indicating wattmeter, recording watt-hour meter and recording voltmeter. Right-hand unit controls twelve feeders each with an ammeter, ammeter transfer switch and oil circuit-breaker control.



Right-hand unit (rear view) carries watt-hour meters and test blocks for each generator circuit. Generator regulators are in compartments behind hinged doors above the regular control handles. Center unit carries a totalizing watt-hour meter and test block. Left-hand unit carries watt-hour meters and test blocks for six feeder circuits.

•

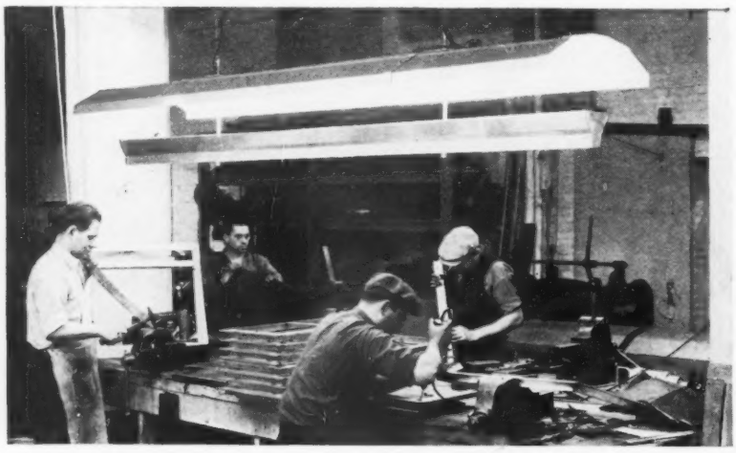
Electric Welder

Special welder; in various sizes up to 250 kva. **Eisler Engineering Co., Inc.**, Newark, N. J.

Welding horns 48 in. long are provided on a welder recently built for use in manufacturing neon signs, metal boxes, office furniture, metal doors and similar work. When equipped with a motor drive this welder can make from 30 to 100 welds a minute, it is claimed.

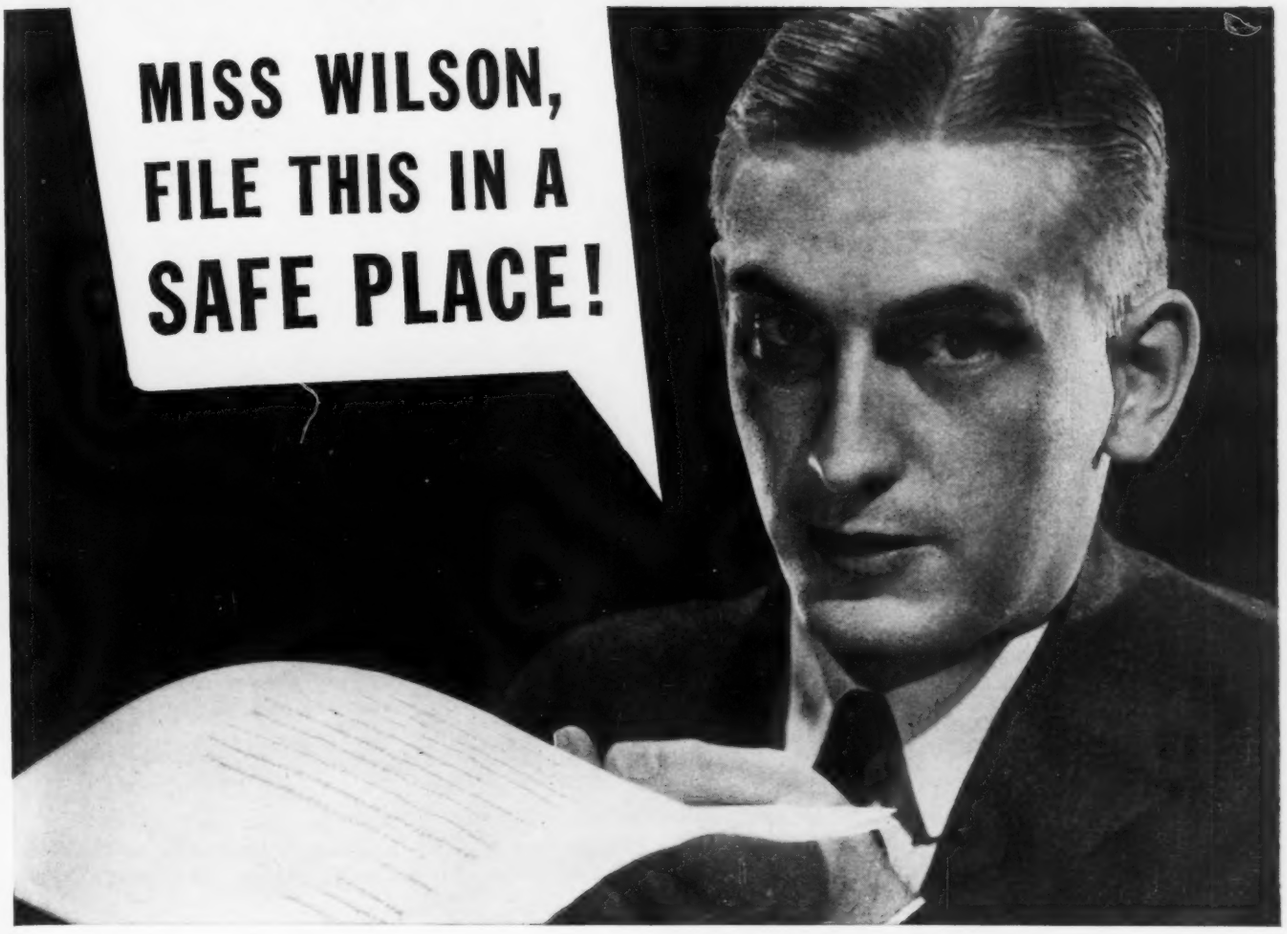
Industrial Lighting Unit

Local, high-intensity, indirect lighting for special industrial applications is provided by this new fixture. Light from 100-, 150- or 200-watt lamps in the aluminum trough is reflected from the steel-diffusing hood—instead of from the plant ceiling—broken up and redirected to the working level. Unit is suggested for such applications as mass production assembly lines, inspection and sorting tables, printing establishments.



"Light-Hood"; standard lengths, 10 ft., available also in special lengths; over-all width, 30 in. **Curtis Lighting, Inc.**, Chicago, Ill.

MISS WILSON, FILE THIS IN A SAFE PLACE!



What do you mean SAFE PLACE?

In most businesses "File in a safe place!" is a perfectly meaningless phrase.

Consider your own case. Few papers are of greater value to a utility than accounts payable vouchers, engineering and construction data and valuation and appraisal reports. Their loss might set you back ten years. Yet at this moment they are probably in ordinary steel files. Files that become blistering hot the minute a fire breaks out, charring priceless records to a crisp!

This is a needless risk today. The Remington Rand Safe Cabinet can give four hour certified fire protection to *every vital paper* your business requires. It bears the highest certification awarded by the Underwriter's laboratories.

BURNED FILE *What a five minute fire does to papers stored in steel files . . . irreplaceable records gone forever!*

SAFE FILE *The Safe-Cabinet gives 1, 2 or 4 hours certified protection to every vital paper your business requires!*

30 MINUTES TO 4 HOUR FIRE PROTECTION

Remington Rand offers a complete range of equipment permitting you to protect records according to their value and the risk. From the new Certi-file which gives 30 minutes certified protection for little more than the cost of an ordinary file, to the Safe-Cabinet line offering one, two and four full hours of protection! For more complete information mail the coupon today for "Pieces of Paper". Sent free, without obligation.

MAIL COUPON
for Free copy
"Pieces of Paper"

Remington Rand Inc. Dept. U-134
465 Washington Street, Buffalo, N. Y.

Without obligation, please send "Pieces of Paper" analyzing the range of protection afforded by Remington Rand equipment.

Name .....

Firm Name .....

Street Address .....

City and State .....

OK.. it's from Remington Rand

Impulse Turbine Repairs Made by Arc Welding

[*Continued from page 43*]

ing was done with wheels made for the high-speed, pneumatic grinders. These wheels were sections of buffing wheels having emery dust glued and baked into the periphery. The resulting flexibility of the wheels had both a good cutting surface and the advantage over solid wheels in producing smooth contour surfaces free from hollows.

Tests subsequent to the rehabilitation of the buckets show an increase in full load efficiency of about 3 per cent was gained from the welding. The cost of the job was about 6 per cent of the cost of rebucketing. It is impossible to predict the remaining service lift of the buckets, but no cracks or other defects have appeared during the past seven months of continuous full-load optput.

Testing Set of 350 Kv. for High-Voltage Research

[*Continued from page 49*]

at too high a voltage or before the proper closing voltage has been set. An interlocking circuit is provided which will prevent energization of the test transformer unless the gate separating the control from the test area has been closed. With the set in operation, the opening of this gate by an absent-minded operator will cause immediate disconnection of the supply.

To provide against absent-mindedness in the operator being carried to the point of opening the disconnects before opening the breaker, contacts on the lever mechanism of the disconnects act to open the breaker upon the slightest movement of the lever handle. Oscillographic tests show that it is practically impossible in normal operation to open the disconnects in advance of the separation of contacts in the oil breaker.

The control bench overlooks a test area approximately 15 ft. wide and 45 ft. long with a ceiling clearance of 20 ft. A 1-ton overhead rail crane covers the test area. For special set-ups the high voltage can be carried directly from the set through a large window to a convenient and ample area outside of the building.

Proximity of the test area to the control bench and the danger that might sometime exist either of flying porcelain or a wild arc led to the installation of a protective screen. This screen consists of ½-in., twelve-gage wire mesh, on a 10x4½-ft. frame. It can be lowered from its normal out-of-the-way position to its protective location just in front of the operator at the control table in the manner of the conventional window sash.

Since its installation the high-voltage test set has been of inestimable value in testing 132-kv. equipment for the bureau's receiving stations and in checking apparatus for the 287-kv. Boulder transmission line. Should unforeseen problems arise in the operation of the Boulder line the 350,000-volt set will undoubtedly be destined to play the important rôle in solving these difficulties.

Central Conveyor Control Expedites Product Handling

[*Continued from page 50*]

four short rings in accordance with an established code. At the control station this causes a white light to illuminate the transparency involved, while a gong repeats the signal to the operator. Before starting the unit the control station operator sends the same signal back by means of the black push button located below the transparency which controls gongs located at intervals along the conveyor. This informs the foreman that his signal has been properly received and also warns any one working on or near the conveyor that it is to be started. The operator then starts the conveyor and extinguishes the white light by pushing the white reset button. One reset button takes care of eight units. The same procedure is followed in stopping a conveyor.

Ammeters are provided to indicate to the operator the load on the most important conveyors so that he can anticipate probable difficulties. These are located above the transparencies. On the right-hand end of the board are located two induction type time-delay relays and four semaphore type signal lights, two of which are red and two green. This equipment is actuated by photo-electric relays mounted in the chutes through which bags are delivered to two spacer conveyors.

It is desirable to have the bags of raw sugar delivered uniformly to the refinery. The function of the spacer conveyor is to hold back the bunched bags as they come from the steamer or from storage and feed them at a uniform rate to the belt that delivers them to the refinery. This is accomplished by using a slat conveyor, a portion of which is inclined at an angle steep enough for the bags to slide down it if unobstructed. The bags are fed onto the upper end of the inclined portion and slide down, finally coming to rest on the horizontal portion or against the bags ahead, if they are being delivered faster than the conveyor feeds them to the refinery.

In order to prevent blockades if the bags are delivered so fast that they fill up the entire spacer conveyor, the relays and signals referred to above were provided. As each bag passes the photo-electric relay the green signal is briefly illuminated and the time-delay relay momentarily energized. The continual flickering of the green light keeps the operater advised that the relays are functioning properly. If the bags should intercept the light beam long enough for the time-delay relay to time out, the red light is illuminated and a gong sounds. The operator then shuts down the feeding conveyor until the spacer has had an opportunity to clear itself.

The equipment described has been in use for some time and has more than paid for itself in avoiding delays and by facilitating and smoothing out the various warehousing operations.

•

Grid Unit Nears Completion

The fourth and final section of the big Ironbridge power station is now forging ahead in Great Britain. This important link in the national Grid network has been under development for five years. When completed it will have a total productive capacity of 200,000 kw. and will be one of the main sources of power for the West Midlands region. The third section is now well under way and comprises a 50,000-kw. turbo-alternator, the fourth of the series, and three additional boilers, the estimated cost being £662,000 ($3,310,000).

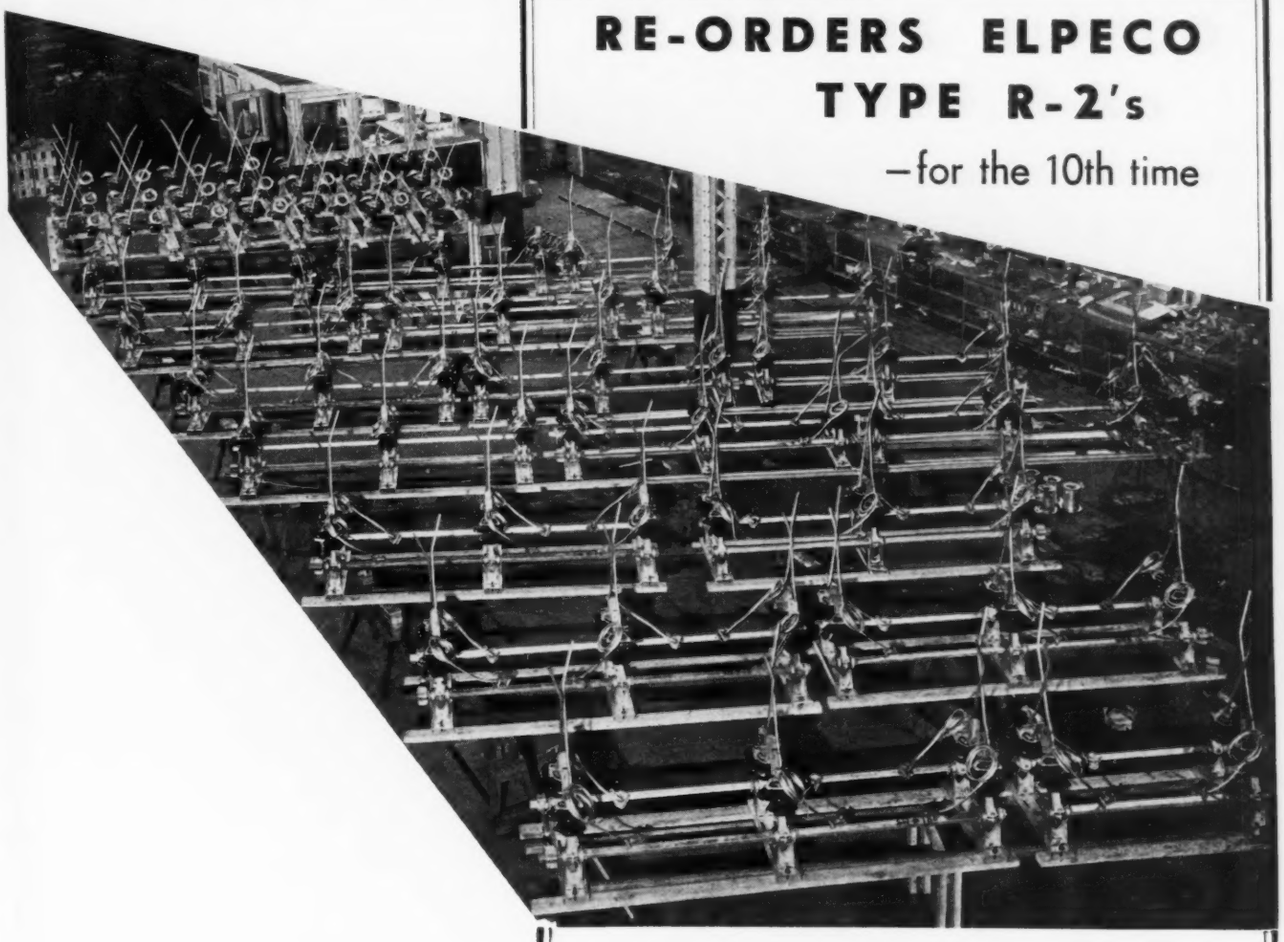
•

Fuel Handbook Best Seller

The handbook entitled "Technical Data on Fuel," published by the British National Committee of the World Power Conference, has become a best seller among technical publications. Its sale is steadily increasing in the United Kingdom and the book has been adopted by fuel technologists in more than 25 other countries. A second printing of the fourth edition has just been ordered.

RE-ORDERS ELPECO TYPE R-2's

—for the 10th time



View: The photo shows final assembly work on 25 Type R-2 ELPECO Horn Gap Air Break Switches 400 Amp., 3 Pole, for 33Kv service. They are for a large utility that, from long experience, values highly the Type R principle.

The best evidence of this esteem is the fact that they have in service 310 ELPECO switches of this type.

Refer to ELPECO Catalog No. 36 —Section 3200, for the features that have established the Type R ELPECO as a standard for dependable, low cost service.

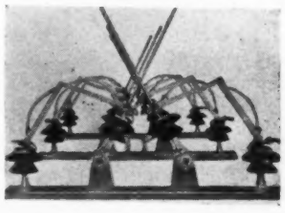
ELECTRIC POWER EQUIPMENT CORP.

412 N. 18th St. Philadelphia, Penn.

The ELPECO

TYPE R PRINCIPLE

Set a Standard



Nearly 20 years ago the advent of the ELPECO double tilting air break switch established a much-needed improvement in switching. Thousands now serving in every state of the Union, Canada and in foreign countries give evidence of its leadership for interrupting transformer exciting currents, line charging currents and load currents.

DIAMOND VULCANIZED FIBRE

A tough, Strong, Light, Versatile Insulating Material

Tough as horn. Almost as strong as Iron. Lighter than Aluminum. Adaptable as brass. These may seem like strong statements to make about any ONE material. Nevertheless they are true! DIAMOND VULCANIZED FIBRE offers you all these properties *plus* good electrical insulating properties. Made in sheets, rods and tubes, all readily fabricated, DIAMOND VULCANIZED FIBRE is adaptable to many mechanical, electrical and thermal insulating parts.

Its light weight makes it an economical material to use. Many more punched fibre pieces can be made from a pound of fibre than can be made from a pound of most comparative materials. You can probably use DIAMOND VULCANIZED FIBRE in your product or process to improve performance, effect economies, or increase salability. Our technical staff with its varied experience is at your service to advise you where it may be advantageous for you to use DIAMOND VULCANIZED FIBRE.

CONTINENTAL-DIAMOND FIBRE COMPANY
Newark, Delaware

Represented in Canada by

DIAMOND STATE FIBRE CO. OF CANADA LIMITED
TORONTO — MONTREAL

Flood Control and Power Cannot Mix

[*Continued from page 64*]

part in that he would raise some of the additional money that will be needed by lowering the present individual income exemptions.

President Roosevelt agrees with Harry Hopkins' conviction that there are some five million families in this country whose incomes must be augmented by the federal treasury *permanently*. He also agrees with Hopkins that the government is not spending enough for relief now—that it has not scratched the surface on housing, for instance.

So do not be deceived by these optimistic interviews by Senator Harrison, chairman of the Senate finance committee, or Speaker Bankhead, or any one else on Capitol Hill that federal expenditures will be trimmed a little, and no more taxes will be levied. More taxes *will* be levied.

What Price Incremental Energy

[*Continued from page 65*]

(b) E. W. method based on average customers, E.E.I.:

$$\text{Rate} = \frac{\$2.842 - \$2.818}{60.01 - 56.06} = \$0.00608$$

(c) Total incremental revenue and sales, eliminating customer count:

$$\text{Rate} = \frac{\$25.517.000}{1,396,962,000 \text{ kw.-hr.}} = \$.0183$$

(d) Our method, eliminating the rate cut on existing load, as demonstrated:

$$\text{Rate} = \$0.0406$$

J. H. SKEEN,
Public Service Company of Colorado, Denver.

[The paragraphs to which Mr. Skeen objects were purposely written to provoke discussion. The carefully prepared refutation by Mr. Skeen is well worth study.—EDITORS.]

•

Utility Pays $26,457 Tax

A franchise tax totaling $26,457 has been paid the city of Houston, Tex., by the Houston Lighting & Power Company on its last year's operations under its profit-sharing agreement with the municipality. Under the terms of the agreement the company is allowed a profit of 8 per cent on its investment, plus 4 per cent depreciation. All profits above this 12 per cent are divided equally with the city.

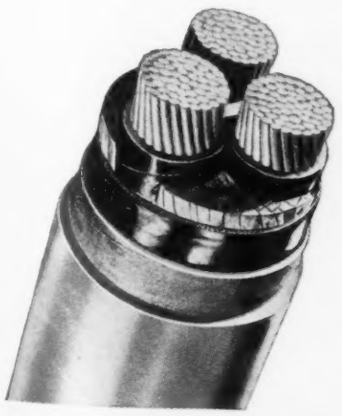
Modern Testing Facilities assure the *High Quality* OF ROEBLING POWER CABLES

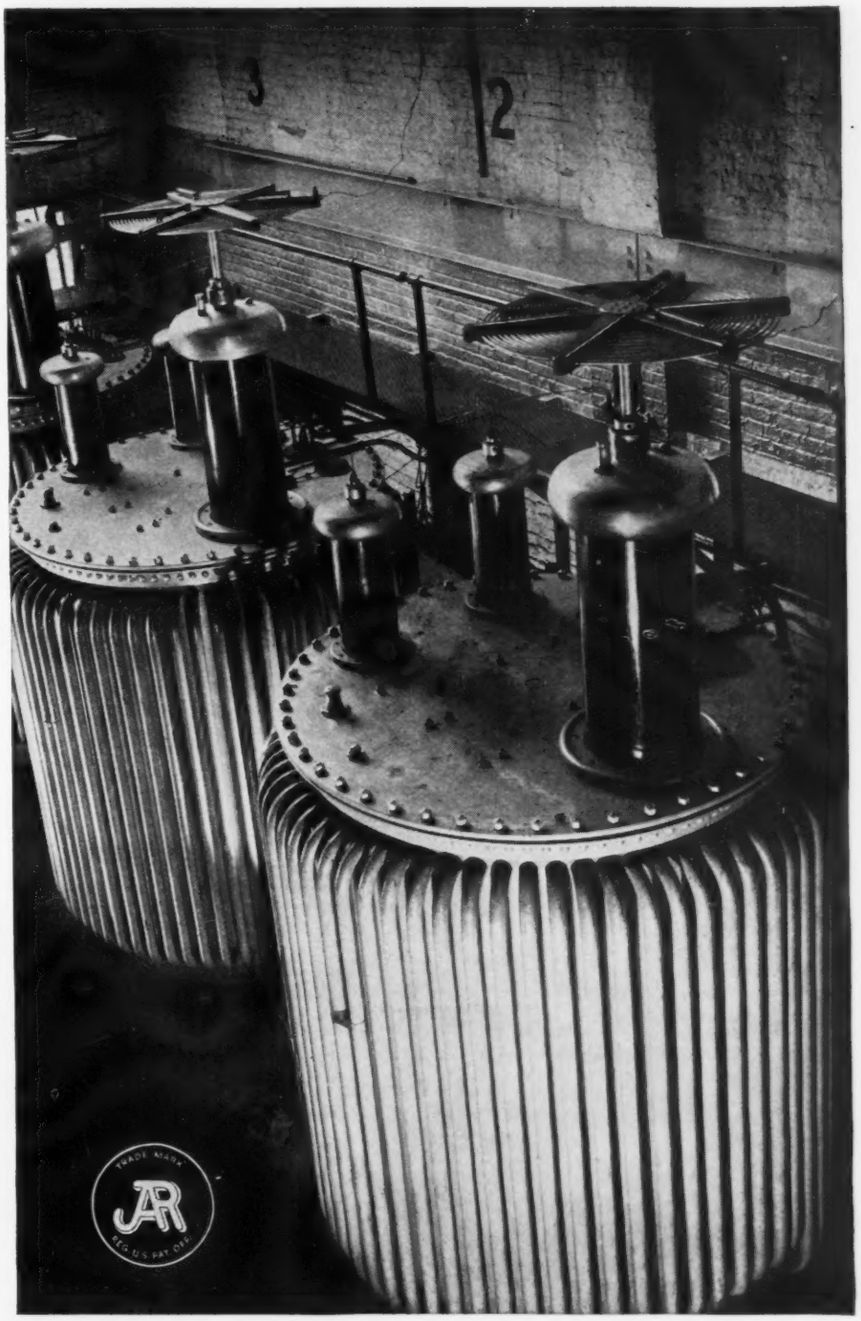
THESE huge transformers... with an ultimate capacity of 400,000 volts... play an important part in the complete Roebling test program. They stand as a symbol of the ceaseless checking and testing that go on at Roebling to maintain the high standard of Roebling Power Cables.

There are over 60 other types of Roebling Wires and Cables ranging from hair fine magnet wire to heavy power transmission cable. We would welcome your inquiry for further information and prices.

Roebling Varnished Cloth Cable...
is available in single, two and three conductor types; for a wide range of voltages; in all commercial sizes. Braided or leaded. Also with steel, zinc, or bronze tape, or round wire steel armor.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

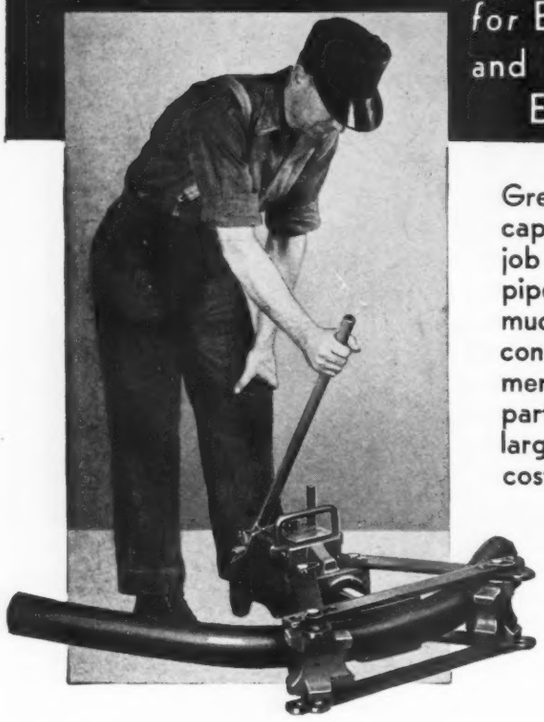




ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

Use GREENLEE TOOLS

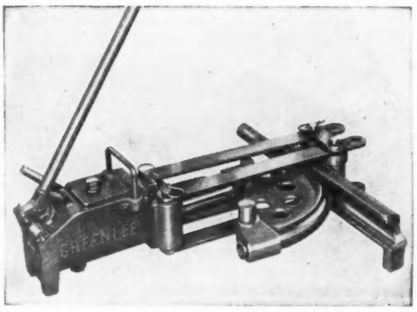
for Bending Conduit and Pushing Pipe... Economically



Greenlee Tools not only are capable of doing a better job of conduit bending and pipe pushing, but they do it much faster. That is why contractors, maintenance men and construction departments are able to make large savings in installation costs over the methods previously used. So important have these savings been in many cases that a number of users have reported to us that their machine paid for itself on the very first job.

Hydraulic Benders

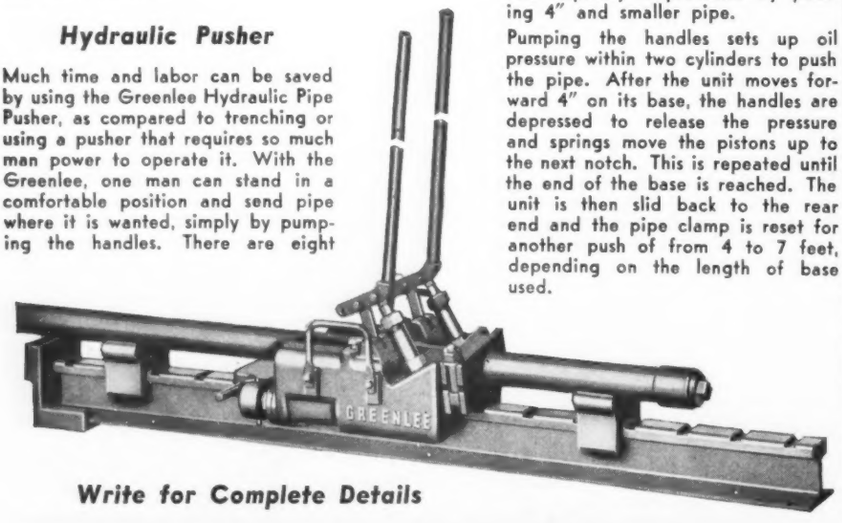
Above is the Rigid Conduit and Pipe Bender in action. Note how, by pumping the handle, a shoe is forced against the conduit, which is held at two points by formed support castings. It is readily portable and simple to operate. Bends made with it are smooth and accurate, with very little distortion in the metal. The No. 770 bends all sizes of conduit from 1¼" to 3". The large bender, No. 775, handles all sizes from 2½" to 4½". When thin-wall steel conduit is to be bent, the No. 770-T Bender, shown to the right is used. It is the same as the No. 770, but has attachments for bending 1¼", 1½" and 2" thin-wall conduit.



Hydraulic Pusher

Much time and labor can be saved by using the Greenlee Hydraulic Pipe Pusher, as compared to trenching or using a pusher that requires so much man power to operate it. With the Greenlee, one man can stand in a comfortable position and send pipe where it is wanted, simply by pumping the handles. There are eight speeds for varying soil conditions, and capacity is provided by pushing 4" and smaller pipe.

Pumping the handles sets up oil pressure within two cylinders to push the pipe. After the unit moves forward 4" on its base, the handles are depressed to release the pressure and springs move the pistons up to the next notch. This is repeated until the end of the base is reached. The unit is then slid back to the rear end and the pipe clamp is reset for another push of from 4 to 7 feet, depending on the length of base used.



Write for Complete Details

GREENLEE TOOL CO., 1705 Columbia Ave., ROCKFORD, ILL.

Recent Rate Changes

HARTFORD ELECTRIC LIGHT COMPANY'S retail customers will be granted a 40 per cent cut on their April bills this year. The lack of the customary extensions to lines and plants during the past few years has resulted in a rise in the ratio of reserves to property to a point which the directors consider is slightly above that required by conservative operation. The revenue which normally must be set aside as a reserve can be reduced for 1937, and this, coupled with a sustained increase in the volume of the company's business permits resuming the practice of a few years ago of a so-called customer dividend. President V. E. Bird states that this discount should not be confused with the former October customer dividend, which when declared must be based on the earnings of the company to that date. The management prefers to make a substantial rate cut for one month under present conditions to establishing a permanent reduction, and its ability to make a customer dividend allowance in October will depend on continued growth of business, absence of major labor troubles and a surcease from further burdens relating to taxes and other governmental activities.

NEW JERSEY POWER & LIGHT COMPANY reduced electric rates $174,040, effective March 1. Of the reduction, $109,743 will benefit residential users; $26,100, commercial, and $38,000, power customers. Under the revised schedule no change is made in the base rate of $1 for the first 11 kw.-hr. The new schedule calls for a rate of 7 cents for the next 25 kw.-hr., 5 cents for the next 64, 3 cents in the next 100 block and 2 cents thereafter.

JERSEY CENTRAL POWER & LIGHT COMPANY will reduce its electric rates by $180,000, effective April 1. At least 65 per cent of the reduction is to be in residential rates. The company's rates have been reduced a total of $607,300 since June 1, 1935, of which $235,300 has been voluntary after negotiations.

INDIANAPOLIS POWER & LIGHT COMPANY has been ordered by the state Public Service Commission to reduce their rates $525,000 to $550,000 a year. The commission maintained that the rates are "unjust and unreasonable and excessive." The order was temporary and affects billings of April 1. A permanent rate will be established in a permanent order forthcoming after more study of hearing evidence. The order lowered rates for residential and commercial power users in city and rural areas. It fixed the minimum monthly charge for residences at 75 cents, which is 10 cents higher than the current charge. The minimum monthly rural residential bill was fixed at $1.

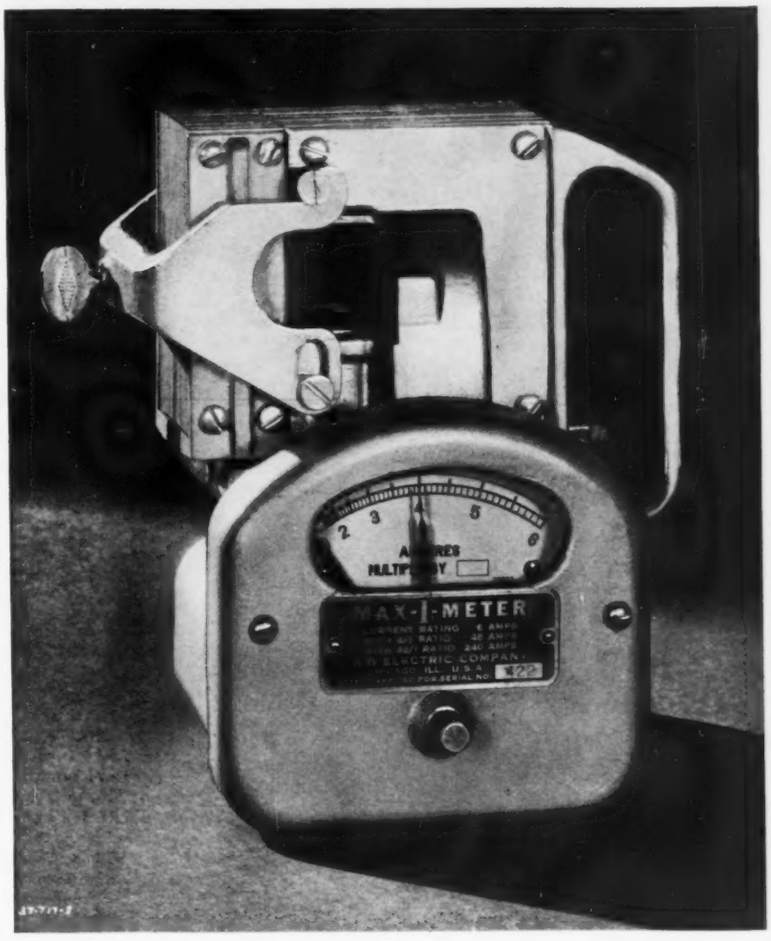
VIRGINIA PUBLIC SERVICE COMPANY has filed a new rate schedule for consumers of electric power in Arlington, Alexandria and vicinity which will save more than $100,000. Commercial as well as residential consumers served by the company will be benefited by the new scale. The new residential rate is 5 cents for the first 20 kw.-hr., 3.9 cents for the next 50, 2.8 cents for the next 130 and 2 cents for all over 200, with $1 as the minimum charge. Under the present rates, the charge is $1 for the first 10 kw.-hr., 3.9 cents for the next 60, 2.9 for the next 130 and 2 cents for all over 200. The new commercial schedule is 5 cents for the first 20 kw.-hr., 3.9 for the next 480, 2.9 for the next 4,500, 2.5 for all over 5,000, with $1 as the minimum monthly charge. The present commercial rate is $1 for the first 10 kw.-hr., 5 cents for the

Check the maximum demands on your distribution transformers

. . . . . **regularly and**

. . . . . **accurately**

H D MAX-I-METER

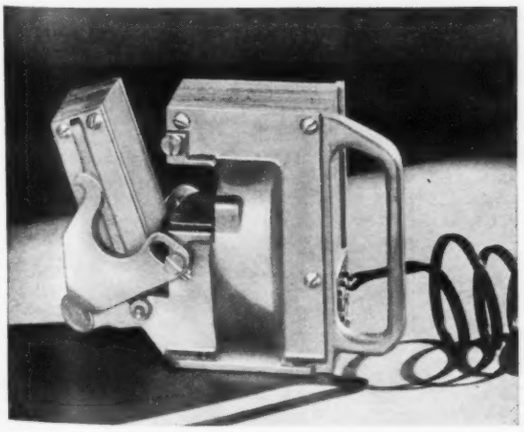


The H D MAX-I-METER affords a low cost, dependable method of knowing your maximum load for any given period. It helps utilities to profit more greatly from new loads by making maximum use of existing facilities and equipment.

The MAX-I-METER is a combination of an electro-thermal type Lincoln maximum demand meter and a multi-range split core current transformer.

No skill required to use it. Simply clamp the MAX-I-METER over one of the transformer leads and let it hang there as long as you want the test to run. A maximum pointer held by a friction device retains the highest reading until reset.

H D MAX-I-TRAN



An accurate method for testing A.C. loads economically and conveniently

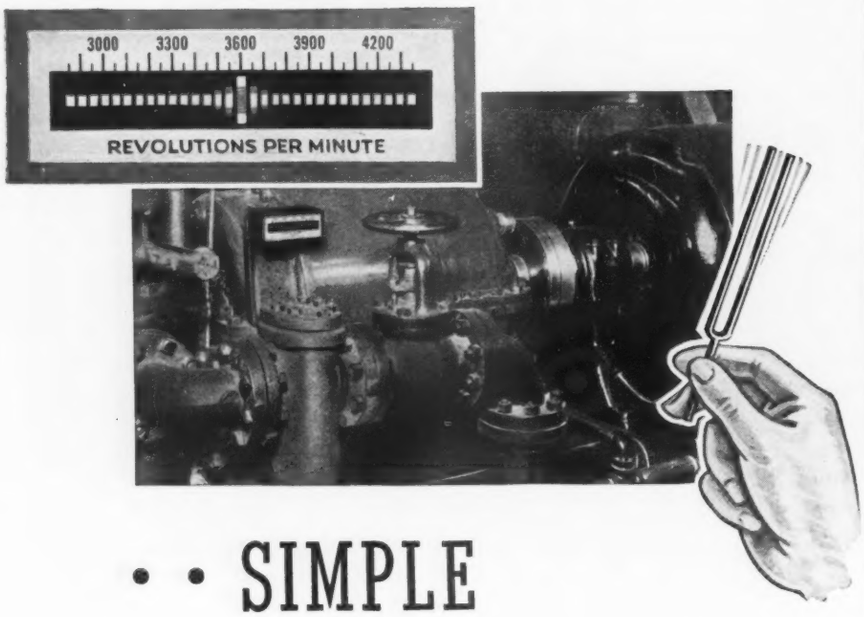
The MAX-I-TRAN is recommended for use with any indicating or graphic recording Ammeter. It is a split core current transformer and affords reliability in testing A.C. loads. The transformer is clamped over the conductor to be tested. It is not necessary to make any live connections when using it nor does it interfere with service. Simple to use. It is lightweight and weatherproof. The MAX-I-TRAN has a 5 ampere secondary. Has ratios of 8/1, 20/1, 40/1, and 100/1.

Send for new bulletin

H-D ELECTRIC COMPANY

100 W. MONROE ST., CHICAGO, ILL.

SPEED MEASUREMENT



• • SIMPLE AS A TUNING FORK

The sole mechanism in a Frahm Tachometer is a set of very accurately calibrated steel reeds. These reeds vibrate in tune with the slight vibration caused by the rotation of the machine on which the instrument is held or mounted. This *resonant vibration* of the reeds is clearly and instantly read on the scale as revolutions per minute.

The principle is as unique as the method of indication . . . the instrument as simple as it is accurate. There are no moving parts to wear, adjust or renew . . . no belts, gears, shafts . . . no magnets or electrical connections.

The Frahm Vibrating-Reed Tachometer can be used in any position . . . gives years of trouble-free service . . . never needs oiling . . . seldom if ever requires recalibration.

Built for permanent mounting, also for hand use in servicing, installation and maintenance work. Bulletin 1390-CW fully describes this unique instrument, illustrates clearly how machine vibration is used to indicate rotating speeds accurately . . . ask for a copy.

Frahm Tachometers, for measuring speeds between limits of about 800 and 30,000 r.p.m., are standard equipment with builders of steam turbines and other machinery . . . also are invaluable for measuring r.p.m. of totally enclosed motors, small motors, centrifuges and other equipment where it is dangerous or impossible to measure speed by any other means. And they are unique for measuring *vibrations per minute* of vibrators and pneumatic hammers and drills.

•

Consult with us about any speed measurement problem. We offer a complete line of high-quality instruments of direct reading, centrifugal and chronometric types to meet practically every requirement . . . will gladly answer specific questions, make recommendations, and send bulletins on instruments adaptable to your needs.

JAMES G. BIDDLE COMPANY

Electrical and Scientific Instruments

1211-13 ARCH STREET, PHILADELPHIA, PA.

"FRAHM" TACHOMETERS

next 190, 4 cents for the next 300 and 3 cents for all over 500.

Salem Electric Light Company has made up a new schedule by which the base rate, for 15 kw.-hr., is reduced from $1.12 to $1.05 per year, and other rates are correspondingly reduced for residential and commercial uses. The new rates, if accepted, will become effective April 1.

Nevada-California Electric Corporation has announced a reduction of $53,000 annually in the electric rates of Victorville, Barstow, Palm Springs and other cities. Other communities affected are Big Pine, Bishop, Elsinore, Hemet, Riverside and Brawley.

Home Gas & Electric Company, Greeley, Colo., has reduced its electric rates, the new schedule to become effective April 1. The complete schedule has not yet been announced.

Illinois Commerce Commission has announced that total estimated annual savings through rate reductions for the month of February amounted to $16,267. Illinois Power & Light cuts totaled $12,387; Illinois Northern Utilities, $3,500; Central Illinois Public Service, $230 and the remaining $150 was made by the Southwestern Bell Telephone Company.

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Municipal Plants

Cumberland, Md.—Through the action of the Maryland General Assembly residents will not be given an opportunity to vote on the question of whether a $2,000,000 municipal power plant will be established. A bill providing for the vote was introduced early in the present session. When the bill came before the House of Delegates it was defeated and to make this defeat lasting what is known as the "legislative clincher" was applied. The parliamentary significance of this action is to prevent the same subject from being given any further consideration at the present session of the General Assembly.

Saginaw, Mich.—Unless gas and electric rates are reduced by the Consumers Power Company, "the city will have to consider owning and operating the utilities now owned and operated by the company." This statement was made in a report by the utilities franchise committee which was approved by the City Council. The report included a letter to the power company calling attention to the company's recently declared intention of increasing its power plant equipment. The committee asked that the company install new rates before making any "further expensive capital improvements." The letter also stated that if new rates were not forthcoming the committee would request the company to put a price on its distribution system and would ask the voters to approve the purchase of the system and the issuance of bonds for the construction of a municipal electric plant.

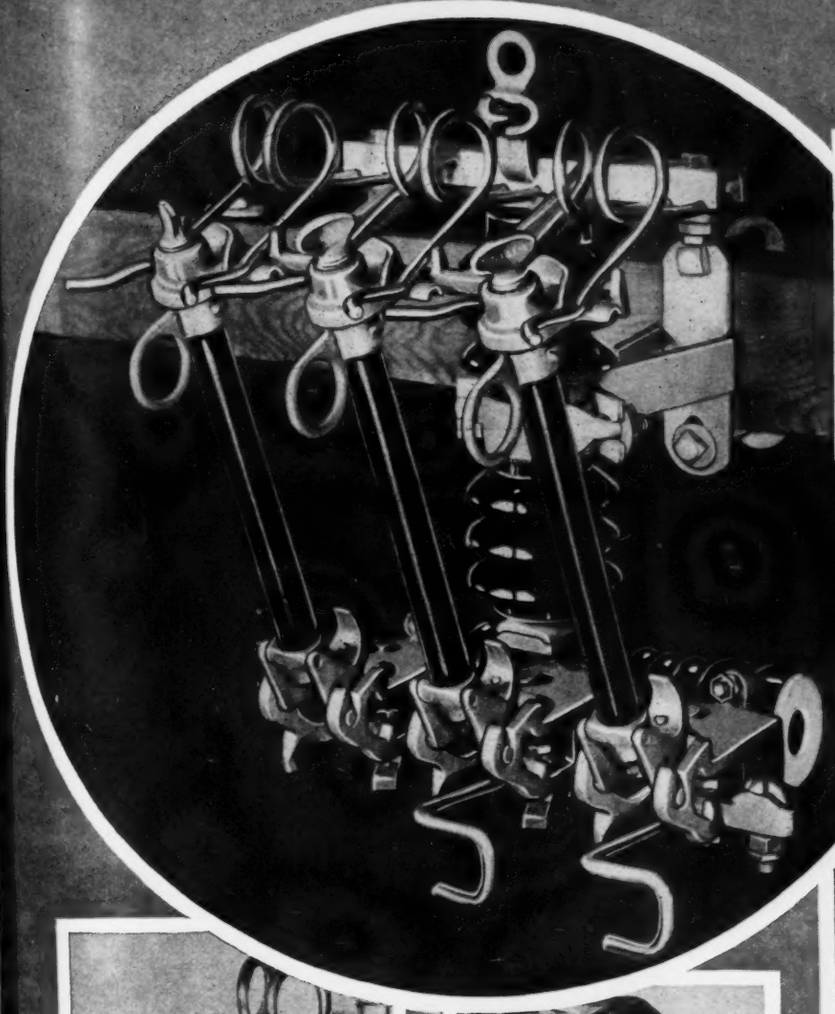
Plattsburgh, N. Y.—Under the provisions of a bill introduced in the Senate by Benjamin F. Feinberg, Republican, of Plattsburg, and referred to the judiciary committee a local law authorizing construction of a local power plant and transmission and distributing system is legalized.

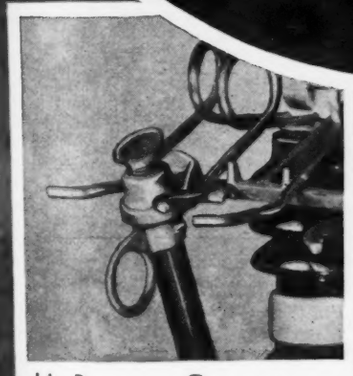
Minatare, Neb.—Voters have approved, 222 to 113, a $46,000 bond issue in a special election for the city to construct, purchase or otherwise acquire its own electric light and power distribution system, substation,

RESTORE SERVICE PROMPTLY *with*

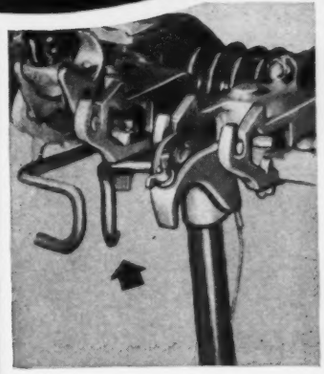
R&IE

Type RKOT REPEATING FUSE

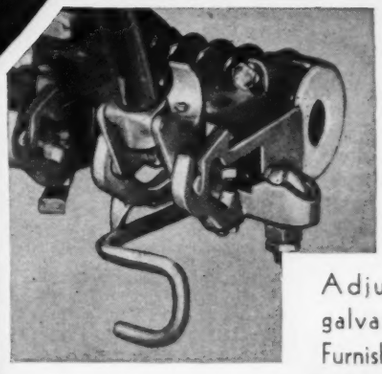




Hi-Pressure Contacts, as designed by originators, are cooler and more positive.

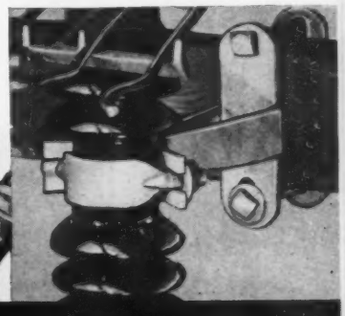


Contact of transfer arm, not dependent on momentum of falling tube.

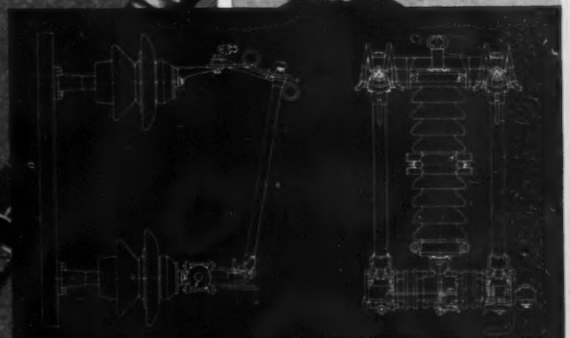


Few, rugged, non-ferrous parts assure reliable, trouble free service.

Adjustable hot dipped galvanized mounting parts. Furnished with half-inch bolts.



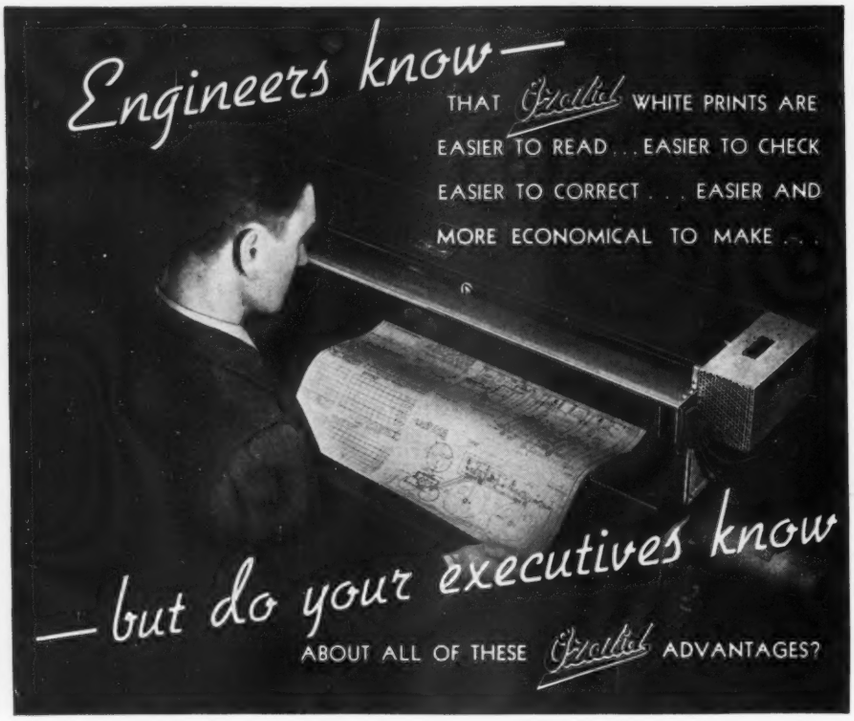
Type "RKOT" will reliably restore service after a temporary fault or isolate a permanent fault with less initial cost than any other type of equipment. The unit is compact, requiring very little mounting space and very simple to operate. Repeaters can be furnished with either clamp or insert head insulator. Always specify Type "PT" universal fuse links for accurate operation on light or heavy faults.



Type 2 RKOT Repeater can be furnished on NE MA insulators in all ratings including 46 KV.

Type RCKOT two shot repeater with current carrying parts clamped on insulators head.

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.


Engineers know—
THAT Ozalid WHITE PRINTS ARE
EASIER TO READ . . EASIER TO CHECK
EASIER TO CORRECT . . EASIER AND
MORE ECONOMICAL TO MAKE . . .
—but do your executives know
ABOUT ALL OF THESE Ozalid ADVANTAGES?

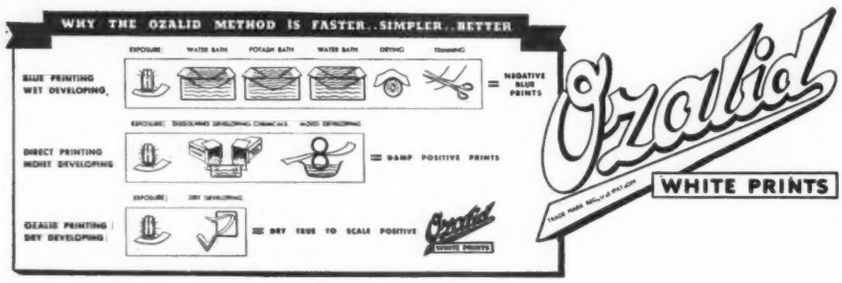
ENGINEERS, draftsmen, and checkers have long acknowledged that clear, clean white prints are easier to read, check and correct . . . prevent those costly mistakes caused when details or corrections are obscured by a confusing blue background.

But here is an improved method of making true-to-scale white prints that is acclaimed by executives, too, as the simplest, cleanest, fastest, cheapest and most versatile process developed . . . not only for engineering, but for production, service and sales.*

The Ozalid Process saves both time and money in making prints. Contrast the two simple steps of this advanced process with those of the conventional blueprinting process or with other direct printing methods. There are no fussy solutions or intricate baths to prepare . . . no drying, no trimming, no waste . . . no noxious fumes. The unit is so clean and compact that it could be used in a private office!

Then, too, substantial savings in drafting time can be effected with Ozalid Transparent Duplicates. One user recently reported that the use of the "blocking out method" has reduced the time of preparing new drawings from days to minutes . . . another has cut the cost of making special application drawings for a standard product from $10.00 to $1.10!

The total savings secured often exceed the moderate first cost the first week . . . and then pay a generous dividend throughout years of service. Whether you are engineer, draftsman, or checker, send for complete information on the Ozalid Process . . . be the first to show your executives how to get better prints at the lowest cost.



Sales and Advertising Managers . . .

have found that the Ozalid Process produces ideal prints for special presentations, sales manuals, graphs and standards books.

OZALID CORPORATION, 354 FOURTH AVENUE, NEW YORK, N. Y.

Please send . . . without obligation or cost . . . complete information on the Ozalid Process with samples or prints and prices.

Name .....

Company .....

Street .....

City ..... State .....

and transmission lines. The Western Public Service Company serves the city with electric power under a franchise which has several years to run. Mayor W. C. Colson, when asked what procedure the city would take next, said he had "no comment to make at this time."

FAYETTEVILLE, TENN.—A P. W. A. grant has been secured with which the city plans the construction of a new electric power plant and distribution system at an estimated cost of $150,000.

STURGEON BAY, WIS.—City Council has voted to repeal an ordinance adopted February 2 which would have provided for a referendum on the proposal to erect an electric power generating plant. The city has been purchasing its energy from the Wisconsin Public Service Corporation.

MT. HOREB, WIS.—Wisconsin Power & Light Company will surrender its electric distributing plant to the village if voters, in 1939, again favor municipal acquisition and if the company is permitted to operate the plant until such referendum is held, according to an agreement filed in Dane County Circuit Court.

PORT OF SPAIN, TRINIDAD—Date for the formal transfer of the Trinidad Electric Company to the city has been set for July 1. The case arose from disagreement between the municipality and the Nova Scotia-owned company concerning the price to be paid by the municipality in acquiring from the corporation the power and traction facilities in Trinidad's capital. In its judgment, the Privy Council directed the Supreme Court of Trinidad and Tobago to find that the board of arbitrators appointed to fix a fair price for the company's property in its award of June, 1935, had not misdirected itself in law except as regards the sum of $69,369 awarded by it under the headings of customs duties. Their Lordships decided that the sum of $25,061 would be substituted for this figure, with the result of reducing the total sum involved from $1,559,543 to $1,515,235. The Port of Spain authorities were given judgment for three-quarters of their costs in bringing the appeal.

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City-Utility Pact Approved

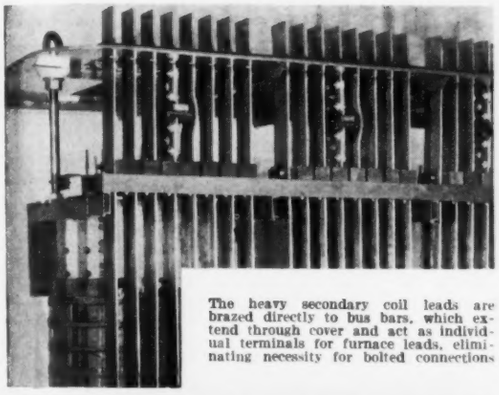
Approval has been given by the Pontiac (Mich.) Commission to two compromise contracts with the Consumers Power Company which are expected to save the city and its residents approximately $70,000 annually. The contracts cover street lighting for five years and water pumping power for two years. The action ended a two-year deadlock caused by the refusal of the utility to pay rental for use of city streets for power poles and the resulting refusal of the city to pay electric bills.

•

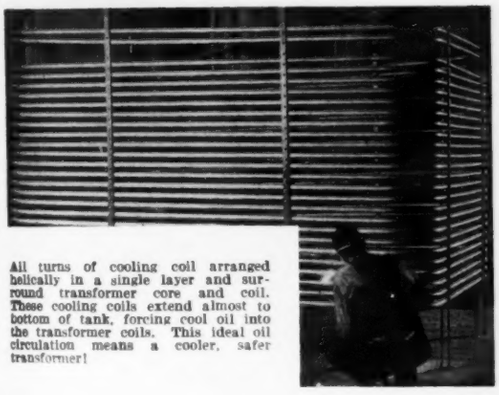
Jackson Votes Bond Issue

Voters of Jackson, Tenn., approved last week the issuance of $364,000 in bonds to match a P.W.A. grant for building a T.V.A. power distribution plant. The vote was 741 to 342.

Pennsylvania FURNACE TRANSFORMERS *–the choice of Heavy Industries*

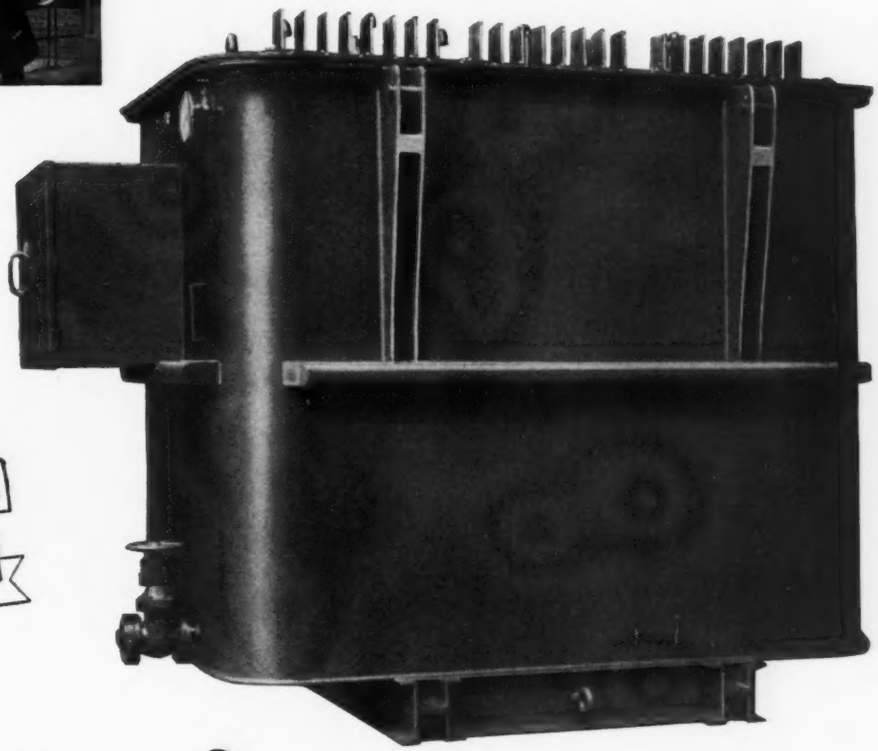


The heavy secondary coil leads are brazed directly to bus bars, which extend through cover and act as individual terminals for furnace leads, eliminating necessity for bolted connections



All turns of cooling coil arranged helically in a single layer and surround transformer core and coil. These cooling coils extend almost to bottom of tank, forcing cool oil into the transformer coils. This ideal oil circulation means a cooler, safer transformer!

THE heaviest industries in the country depend upon Pennsylvania Furnace Transformers, designed and built by an organization with years of ripened experience in this field. No matter how large the installation or how complicated or involved the problem may prove, Pennsylvania has the necessary engineering ability and factory facilities for building the right furnace transformer for your particular requirements.



PENNSYLVANIA TRANSFORMERS

PENNSYLVANIA TRANSFORMER CO., 1701 Island Ave., N. S., Pittsburgh, Pa.

TAYLOR

PHENOL FIBRE
VULCANIZED FIBRE
TAYLOR INSULATION
SILENT GEARS

TAYLOR
ESTABLISHED 1891
TAYLOR FIBRE COMPANY
NORRISTOWN, PA.

Sales Opportunities

OMAHA, NEB.—Nebraska Power Company is considering tentative plans for new steam-electric generating plant in vicinity of O Street. Cost estimated over $1,000,000.

WASECA, MINN.—Cannon Valley Co-operative Power & Light Association, Waseca, recently organized, has voted to merge with Steele-Waseca Electric Co-operative Association, Merton (Owatonna P. O.), Minn., Edward Springer, secretary, and rural electrification in this area will be carried out as joint project, adding about 150 miles to proposed system of last noted organization, making a total of approximately 450 miles of primary and secondary lines in Waseca, Rice and neighboring counties, with outdoor power substation and service facilities. Fund of $275,000 has been secured through federal aid, and an additional appropriation of $150,000 is proposed. Power will be secured from plant of Interstate Power Company. Pillsbury Engineering Company, 1200 Second Avenue South, Minneapolis, Minn., is consulting engineer.

ST. LOUIS, MO.—Crown Cork & Seal Company, Eastern Avenue and Kresson Street, Baltimore, Md., plans installation of motors and controls, regulators, electric hoists, conveyors and other equipment in new multi-unit metal-container manufacturing plant on Natural Bridge Avenue, St. Louis, where eight-acre tract of land has been acquired. Superstructure will begin soon. Cost about $2,500,000. Plant will be operated by Crown Can Company, a subsidiary interest, first noted address. Lucius R. White, Jr., 10 West Chase Street, Baltimore, is architect.

WILMINGTON, N. C.—Tidewater Power Company has plans maturing for transmission and distributing lines for rural electrification in parts of Onslow, Lenoir, Brunswick, Carteret and neighboring counties, totaling about 150 miles, with outdoor power station and service facilities. Financing in amount of $170,000 is being arranged through Federal aid.

BRIDGEPORT, CONN.—Bridgeport Brass Company, East Main Street, plans installation of heavy-duty motors and controls, transformers and accessories, panel boards and controllers, conveyors, electric hoists and other equipment in new addition to brass, bronze and copper products plant. Cost in excess of $2,000,000. Financing has been authorized. Stone & Webster Engineering Corporation, 49 Federal Street, Boston, Mass., is consulting engineer.

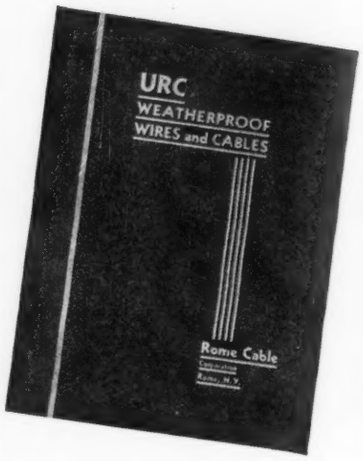
SEATTLE, WASH.—City Council receives bids until April 1 for furnishing and erecting galvanized steel transmission towers for Skagit Transmission Line No. 2, totaling about 11,000,000 pounds of galvanized, fabricated structural steel, with control and relay switchboards. J. D. Ross, City Light Building, is superintendent for municipal light and power department.

PUEBLO, COLO.—Southern Colorado Power Company plans new transmission lines from Pueblo to Fowler, Rocky Ford, La Junta, Ordway, Sugar City and vicinity. Work is scheduled to begin early in April. Company has authorized a fund of about $400,000 for this and other transmission and distributing line extensions in 1937.

DALLAS, TEX.—Coca-Cola Company, North Avenue, Atlanta, Ga., plans installation of motors and controls, transformers and accessories, conveyors, loaders, electric hoists and other equipment in new beverage

WEATHERPROOF WIRES AND CABLES

U. R. C.



A copy of bulletin W.P.-1 will be mailed promptly on receipt of request.

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manufacturing and bottling plant at Dallas, where large tract of land recently has been acquired. Work will begin early in April. Cost about $800,000. Robert & Company, Bona Allen Building, Atlanta, are architects and engineers.

BALTIMORE, MD.—Rustless Iron & Steel Corporation, 1001 Edison Highway, plans power substation with transformers, switchgear and accessory equipment, and power distribution system in new and present mill buildings, to cost $110,000. Work will be carried out in connection with general expansion and improvements in plant, on which work will begin soon, estimated to cost close to $650,000. Motors and controls, conveyors, electric hoists and other equipment will be installed. H. A. Brassert & Company, 310 South Michigan Avenue, Chicago, Ill., are consulting engineers.

HARTINGTON, NEB.—Cedar County Rural Electrification Association, M. L. White, Hartington, secretary, recently organized, has plans maturing for primary and secondary lines in Cedar and neighboring counties, totaling about 350 miles, with outdoor power substation and service facilities. Fund of $450,000 is being arranged through Federal aid. Henningson Engineering Company, Union State Bank Building, Omaha, Neb., is consulting engineer.

MONROE, LA.—Is considering extensions in municipal electric power plant, with installation of new turbo-generator unit, two boilers and complete auxiliary equipment. A new warehouse building for station service also is planned. A bond issue of $1,500,000 is under advisement for this and other municipal improvements.

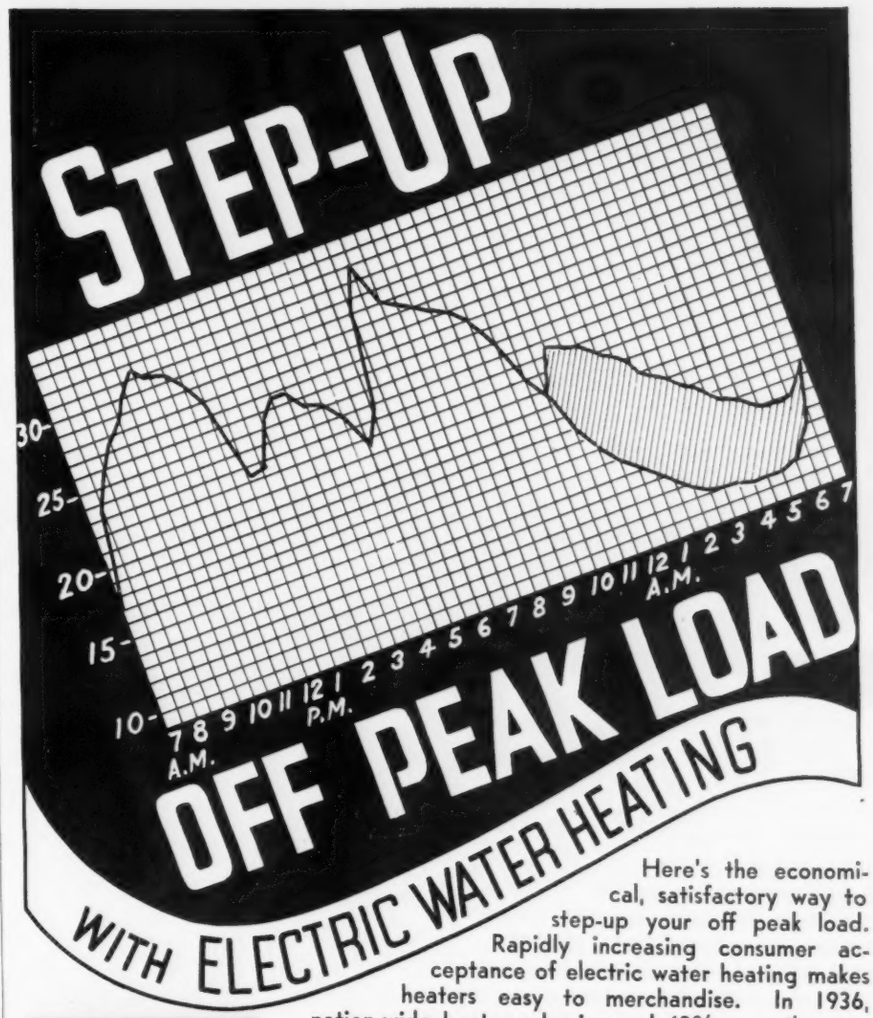
GREELEY, COLO.—Home Gas & Electric Company, Greeley, plans extensions and improvements in local distributing lines, including new lines for service in neighboring areas. Cost close to $150,000. Work is scheduled to begin soon.

ABBEVILLE, S. C.—Has preliminary plans under way for new municipal hydroelectric generating plant, including transmission line to municipality and local distributing system. Estimates of cost are being made. Wiedeman & Singleton, Candler Building, Atlanta, Ga., are consulting engineers.

STANTON, NEB.—Stanton County Rural Public Power District, Stanton, is completing plans for primary and secondary lines for rural electrification in parts of Stanton and neighboring counties, totaling about 280 miles, with outdoor power substation and service facilities. Fund of about $285,000 is being secured through Federal aid. O. R. Tolman, Barkley Building, Lincoln, Neb., is consulting engineer.

JOLIET, ILL.—Public Service Company of Northern Illinois, 72 West Adams Street, Chicago, Ill., is considering extensions and improvements in steam-electric generating plant at Joliet, including installation of new generating unit and accessories for increase in present capacity. Cost reported in excess of $1,500,000. It is understood that work will be carried out later this year.

KEARNEY, NEB.—Buffalo County Public Power District, Kearney, has plans maturing for primary and secondary lines in part of Buffalo and neighboring counties for rural electrification, totaling about 140 miles, with outdoor power substation and service facilities, including power supply for pumping stations in this area; lines will be built to carry power leads for latter purpose. Fund of $212,000 has been secured through federal aid. Work scheduled to begin early in spring.



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